PUBLIC WORKS

Jan. 1952

CITY, COUNTY AND STATE

Special Equipment Speeds Highway Maintenance

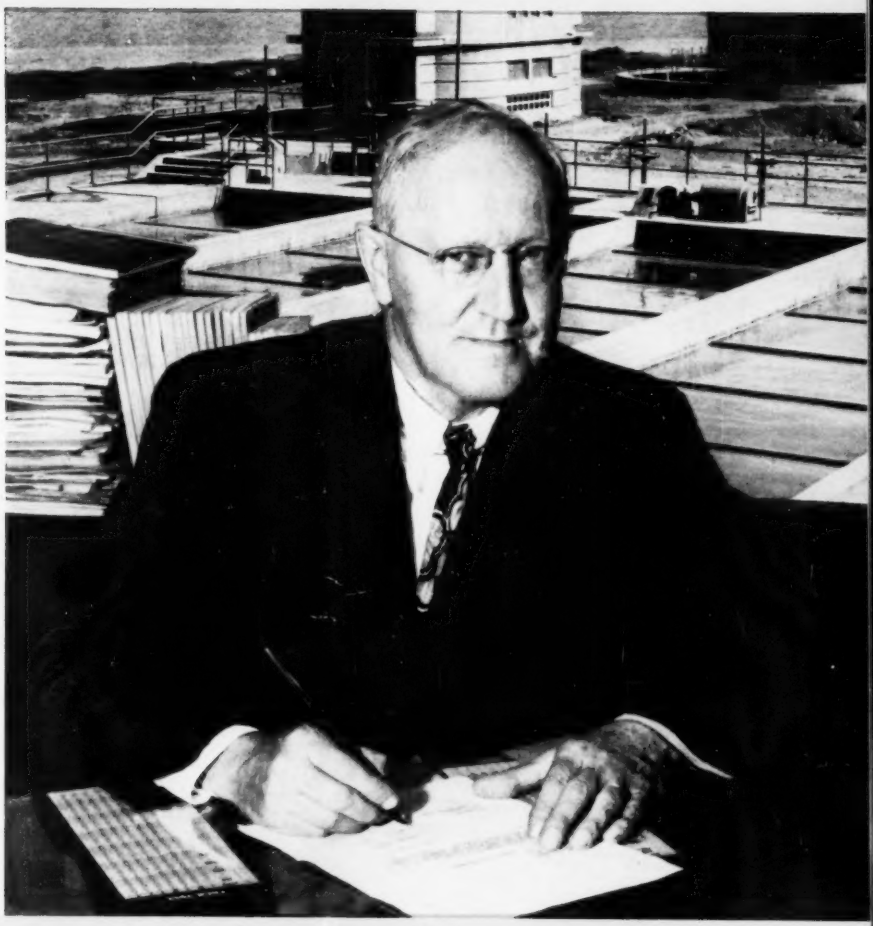
Application of the NRC Filter Formula

Bacterial Quality Objectives for Ohio River

Radioactive Isotopes Trace Subsurface Water

Reducing Highway Maintenance Costs

Pre-treatment of Milk Plant Wastes



Samuel L. Tolman, well-known sanitary engineer, is shown against a background depicting New York's Bowery Bay plant. More on page 16.

GALION MODEL 303 MOTOR GRADER

- **All-gear tandem drive.**
- **Full hydraulic control.**
- **Dependable 50 h.p. diesel engine** (gasoline engine available).
- **Manual or combination manual and hydraulic steering.**

PROFITABLE PERFORMANCE ON MEDIUM-DUTY JOBS

It isn't profitable to use heavy-duty equipment on medium-duty jobs. The GALION 303 is a medium-size motor grader with all the operating features found on much heavier graders — yet it offers the economy of investment and operation necessary for profitable performance on those numerous medium-duty jobs.

Write for literature.

ESTABLISHED 1907 **MOTOR GRADERS • ROLLERS**

THE GALION IRON WORKS & MFG. CO., General and Export Offices — Galion, Ohio, U. S. A.
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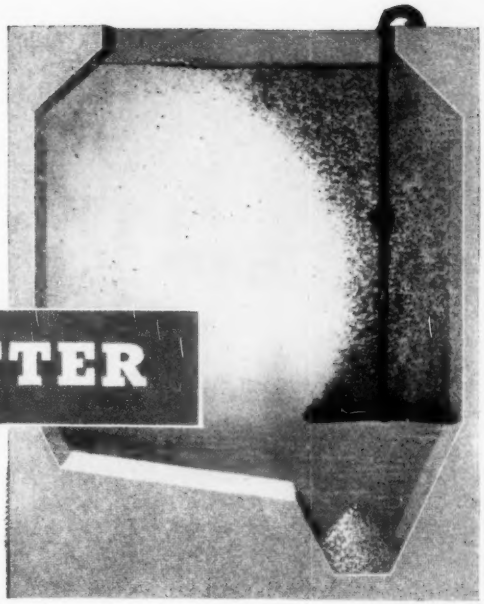
6

IMPORTANT BASIC FEATURES

Chicago

AER-DEGRITTER



MAXIMUM REMOVAL

CLEAN GRIT

NO MECHANISMS

LOW COST

SIMPLE STRUCTURE

AIR CONTROLLED VELOCITIES INDEPENDENT OF FLOW

The Chicago Aer-Degritter provides the only method of removing grit and sand from sewage without movable mechanical equipment. Air introduced through Chicago Swing Diffusers and Precision Diffuser Tubes controls the velocity of the flow. All sand of 0.2 mm. (65 mesh) and larger is washed and deposited in a hopper at the bottom of the tank.

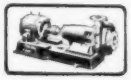
Analysis of grit removed by this system shows less than 10% volatile matter and only a negligible trace of putrescible organics. Because course sewage material will not interfere with the operation of the Aer-Degritter and because it does not affect the hydraulic design of the plant, Aer-Degritters may be installed ahead of all mechanical equipment.

Chicago Aer-Degritters are operating successfully at Oildale, Calif., Columbus, Ohio, Tomah, Wis., Bellaire, Texas and Sedalia, Mo. Aer-Degritters being installed include Fort St. John, B. C., Warsaw, Ind., Elmira, N. Y., Oklahoma City, Okla., Port Washington, N. Y., Anderson, S. C. Design flows of these plants range from .75 to 160.0 MGD.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET **CHICAGO 18, ILLINOIS**



Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

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Thousands use our Readers' Service card to keep up to date . . . do you?

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For the complete story on the new Oliver Industrial "OC-3" and how it can help your operations, see your Oliver Industrial Distributor.

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A complete line of industrial wheel and crawler tractors

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The 1952 volume of Public Works will be available on microfilm through University Microfilms, 313 N. First St., Ann Arbor, Mich.

THE ENGINEERING AUTHORITY
IN THE CITY-COUNTY-STATE FIELD

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Eliminates Re-Handling Of Trash and Rubbish

Dempster-Dumpster Detachable Containers are spotted at business establishments, market areas, schools, etc. and loaded by the user. One truck-mounted Dempster-Dumpster, with only one man, the driver, picks up, hauls and empties, one after another, a multiple number of these containers . . . eliminating re-handling of refuse. Container sizes range up to more than three times the capacity of the average dump truck body. For low cost, efficient and sanitary bulk rubbish collection, your city needs the Dempster-Dumpster System. Manufactured exclusively by Dempster Brothers, Inc.

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THREE STAGES of quick pick-up, hauling and dumping are shown while Dempster-Dumpster is at work in Baltimore.

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THE EDITOR'S POINT OF VIEW

Saving Some of That Hard-to-Get Steel

WE read in the papers quite often these days about the lack of steel and its effect on needed construction. While we cannot ever hope or wish to get along without steel, there are ways and means available for reducing its use on some kinds of work. In this issue is an article telling how you can build good concrete pavements without very much steel; and, of course, the bituminous type pavements, in themselves, get along very well without any steel, though it is needed for bridges and similar structures. In the sewage treatment field, vitrified clay radius blocks —the so-called silo-blocks—can be used at a substantial saving in both cost and steel for filter walls and probably for other jobs around a plant. The use of prestressed construction for digesters and similar structures saves a very material amount of steel.

If engineers will put their minds on the job of saving steel they can do a surprisingly good job; and they can do it without reducing the value of the structures they design.

Engineering and Scientific Manpower Utilization

WITH all of the commissions, committees and conferences on engineering and scientific manpower, not to mention the high-power political appointees brought in to cure the matter, nothing effective seems to have been done as yet to mitigate the wastage of engineers by the military and by the government generally. No one has been able to develop and have adopted a definite policy, though the ends to be attained are quite clear and fairly well agreed on. The trouble seems to be a lack of leadership, which is probably coupled with a lack of authority.

With the military apparently constitutionally unable or unwilling to utilize engineering skills to any marked extent, and with the draft getting harder and harder, the outlook for conserving our scientific skills does not look very promising. It seems to us that, over the years of peace in the past, the engineering profession neglected a big opportunity and a big responsibility—that of teaching our military services what an engineer is and how to use him most effectively. It is true that the opportunity was not easily perceived and no blame should attach for the oversight. But perhaps it is not too late, even now, for remedial action. A few live-wire young men, representing the leading engineering societies, could do a great deal to bring together the viewpoints of the lay military men and the civilian profession. In fact, both groups might learn quite a little from a get-together.

Maintaining the Efficiency of Our Highways

AUTOMOBILES have increased in number faster than road facilities have been expanded; perhaps faster than it has been possible to build the needed roads and streets. These facts throw an exceedingly heavy burden on the highway maintenance organizations. How have they met this problem?

PUBLIC WORKS recently asked a group of representative states, many of them in areas subject to very heavy traffic, what they have done to cope with this problem. The reports from these states have been unanimous in showing a remarkable utilization of machinery to speed up the work, reduce cost and take the place of men who are no longer available. In Pennsylvania, over the past twenty years, the hourly labor rate has increased from 40 cents to $1.05 per hour, but the cost of maintenance has increased only about 10%. In California, the cost of cutting brush, per mile of roadside, has been reduced from $400 by hand to $182 by machine; and a suction device has been developed to pick up bottles and beer cans from the roadside, reducing the headaches incident to this problem.

These are but samples of what has been done to reduce costs by the use of modern equipment. Full descriptions will appear in early issues, beginning with this one. Meanwhile, what some city and county engineers and water works superintendents are doing with labor saving equipment will be told in the same issues.

Gas taxes may be diverted to a shameful extent and material and labor costs may rise; but our highway engineers have shown that, with modern equipment, they can keep America's automobiles rolling. Maybe this will not be at the speed and freedom from traffic interference that we would like; but their contribution is surely a vital one in these days of stress and strain. We congratulate them for a fine job.

Trades in

PREPARES THE SITE—International crawler power and the Bullclam bucket carve out long trenches to bury the piles of refuse.

SPREADS THE REFUSE—The powerful Crawler-Bullclam goes after the dumped garbage, spreading it out in the trench with the long Bullclam front. Speed of the unit keeps it working well ahead of collection trucks.

CRUSHES AND COMPACTS REFUSE—Rolling over the strewn refuse, the rugged crawler uses the specially curved Bullclam front to crush, smash and iron out the trash.

Thousands use our Readers' Service card to keep up to date . . . do you?

Old Trash Fire

How the "one-man sanitation squad" helped Lincoln, Illinois, get rid of a 50-year-old burning dump

Just two years ago, the people of Lincoln, Illinois, put out the fire on a mountain of burning garbage and gave the refuse job for the entire city to one machine.

Since 1898, the city dump had been an eyesore. Rats and flies infested it.

Then Lincoln switched to the sanitary land fill method.

An International TD-14A with a Drott Bullclam went into action. The rats and flies disappeared. So did the smoke and smell—and more refuse is disposed of than ever before.

Here's how this one-man sanitation squad does the job:

The big Drott Bullclam, powered by all the rugged force of the International crawler, digs in, scoops out the excavation. It tackles the refuse as the trucks dump it, crushing, smashing and grinding the bulk flat beneath the specially curved Bullclam front. Then it spreads and grades the cover dirt to finish the job.

Here you have it—the ONLY one-man unit specifically designed to do the complete sanitary fill job. You can get rid of open dumps—save valuable land—cut disposal costs, with the fast-working Drott Bullclam on an International crawler. Ask your International Industrial Distributor for information.

Drott Manufacturing Corporation, Milwaukee 8, Wisconsin
International Harvester Company, Chicago 1, Illinois

GRADES AND LEVELS THE FINISHED AREA—Each night the big red International crawler covers the day's compressed garbage with a dirt layer and then levels the ground with the big Bullclam bucket.

BULLCLAM BY

DROTT

POWER BY

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POWER THAT PAYS

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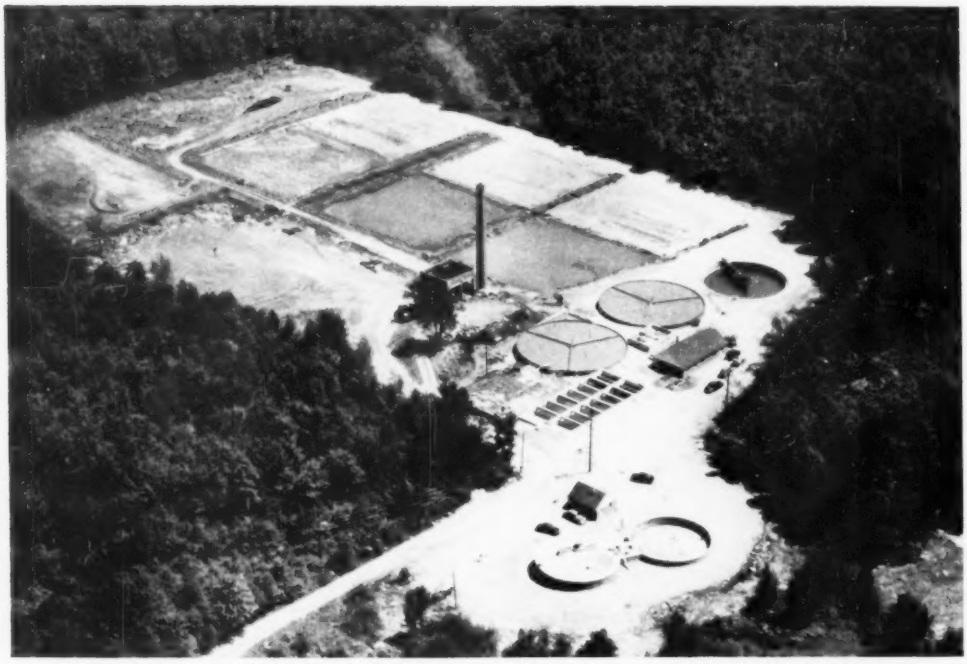

At Monticello, N. Y., peak flow reaches 6.0 mgd, in contrast to 0.6 mgd winter flow. Link-Belt Straightline Sludge Collectors equip two 20 x 95 x 8.8 ft. primary tanks, and L-B Circuline Collector—the 70 ft. dia., 7 ft. deep final tank.

Pick LINK-BELT sludge collectors for summer resort town

Monticello (N.Y.) sewage plant gets economical, flexible treatment for flows that vary as much as 10-to-1

The sewage treatment plant at Monticello, N. Y., presented a tough design problem . . . due to summer population increase from winter's 4300 to around 22,500. This also necessitated a high degree of treatment to protect vacationers from stream pollution and nuisance.

To solve this problem, consulting engineers W. A. Hardenbergh and Olney Borden chose Link-Belt Sludge Collectors—Straightline design on the two primary settling tanks and Circuline on the final settling tank. For both offer famous Straight-line action that accomplishes maximum sludge collection and complete sludge removal in the shortest time. Yet these collectors provide economical operation at all flow conditions.

In addition to the sludge collectors, a Link-Belt Tritor Screen is used to remove the screenings and grit. A Link-Belt Sludge Elevator, liquid lime elevator and a belt conveyor aid in the sludge conditioning and sludge drying.

Our sanitary engineers will be glad to work with your engineers, chemists and consultants—help you get the best in modern water, sewage or industrial liquids treatment equipment.

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12,634

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

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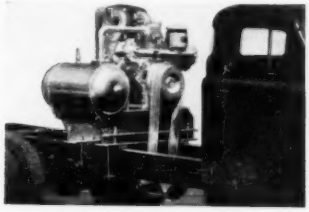
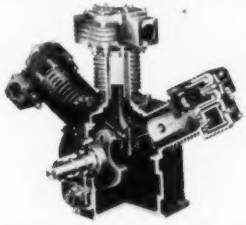
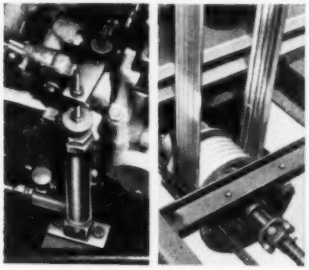


More Capacity: 125 cfm at 100 psi. Runs 2 heavy pavement breakers at full efficiency, with truck engine at only 1750 rpm.



Smooth Operation: No vibration under full load with this perfectly balanced 2-stage W-type compressor unit.



Simplest Automatic Control: Regulates engine speed to air demands without complicated linkage. Positive in action.

Cemco Power Take-Off: No gears. Only 4 moving parts. Clutch controlled from cab.

Utilities that never before used truck-powered compressors are installing the JAEGER TRAVEL-AIR

More air, no vibration, simple automatic control of engine speed—plus the advantages of power take-off

By taking power from your truck engine, which otherwise stands idle 7 hours out of 8, you save $950 to $1,000 in cost, 50% of the maintenance and all the extra weight and bulk of a separate engine and trailer mounting. Also saves waiting for engine to warm up at every job.

By using the air-cooled Jaeger 125 cfm compressor unit (largest selling compressor in the construction field) you get 20 cfm more air to run your tools at full efficiency.

Easy to mount on 1½ and 2 ton Chevrolet, Dodge, Ford, GMC or International trucks of long wheelbase current model. Get our Catalog TC-1, giving full information.

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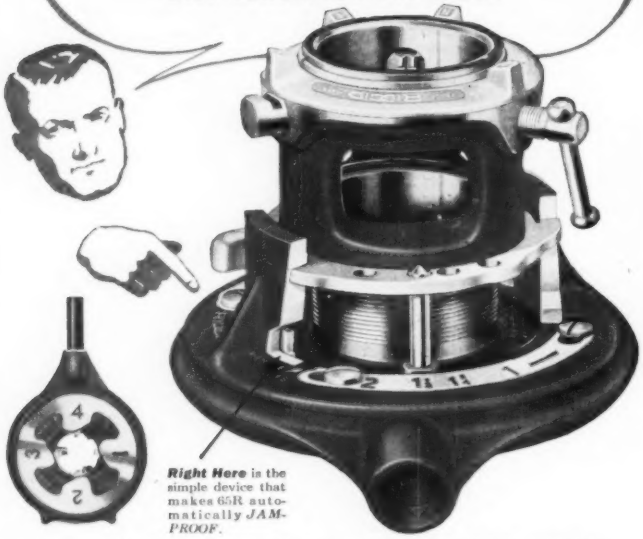
You can't jam the new RIDGID 65R

Really streamlined pipe threading with this RIDGID self-contained die stock



Right Here is the simple device that makes 65R automatically *JAM-PROOF*.

● You don't have to watch it—lead screw can't jam on workholder. New jam-proof drive plate automatically kicks out driving ratchet pawl when standard length thread is cut. Your recent model 65R easily converted—just buy new drive plate, put in place of old plate. Perfect threads on 1" to 2" pipe with one set of 4 high-speed steel dies—sets to pipe size in 10 seconds, mistake-proof self-centering workholder sets instantly! Buy the new jam-proof RIDGID 65R at your Supply House.

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★ Work-Saver Pipe Tools ★

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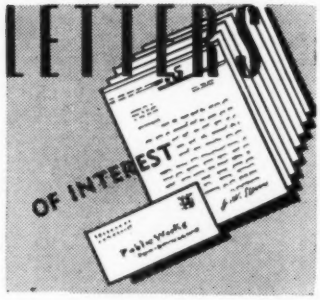

CLAY PIPE LASTS TOO LONG

After 44 years with the Dickey Clay Mfg. Co., I have decided to retire, though I will be around Dickey's off and on in 1952. Clay pipe lasts longer than the men that sell it, so how can I outlive it? It has been a pleasure to meet the fine folks in your organization.

A. G. Frerking
Dickey Clay Mfg. Co.,
Kansas City, Mo.

(Ed. Note: It has been a pleasure to know Al Frerking, too, and when we saw him in Chicago in December he didn't look old enough to retire, nor to have been with Dickey for 44 years. Lots of good times and our best regards to him.)

COMMISSIONS FOR ENGINEERS

The freeze which was placed on the commissioning of 2nd Lts. in the Medical Service Corps Reserve has been removed by authority of AG Letter dated 26 November, 1951: Subject, Direct Appointments in the Medical Service Corps, USAR. The applicant must have completed either the leadership course or six months of enlisted service. This rules out direct commissions to applicants from civilian life.

Lt. Col. R. J. Karpen
Office of the Surgeon General,
Department of the Army,
Washington 25, D. C.

(Ed. Note: Col. Karpen is leaving the SGO for another assignment and letters of inquiry regarding commissions should be directed to the Chief, Medical Service Corps, at the above address. Attention is called to the fact that commissions are available only to men already in the service.)

CATHODIC PROTECTION

It was with great interest that I read the fine article "Redesigning a

INGREDIENTS:
A "Cat" D4 Tractor
A 4-yard truck
A 1-yard loader

FORMULA:
1. Drive bucket of Traxcavator-equipped "Cat" Diesel Tractor into stockpile
2. Back it out
3. Back truck under
4. Dump
5. Withdraw truck
6. Repeat operation three times—and full truckload is on its way

RECIPE for a heaping load in *three minutes flat*

All in three minutes? Yes. Santa Cruz (Arizona) County Supervisor Blain Lewis says his operators can prove it on loose surfacing materials. (Old, hard-packed material may take a little longer, he admits.) On one long-haul job, he adds, they loaded out 100 truckloads in seven hours—with only two trucks working.

"Shuttling" truck and tractor—which involves no time-wasting turning—is the loading method used. Pretty smart! The tractor's the key, of course. It has plenty of power. Sure-footed traction. And nothing beats a "Caterpillar" Diesel Tractor for dependability, say thousands of users.

A word to the wise: There's nothing like good care and "stitch-in-time" inspection for making your "Caterpillar" equipment last extra long. Call in your "Caterpillar" Dealer while he can still rebuild parts before they become unusable.

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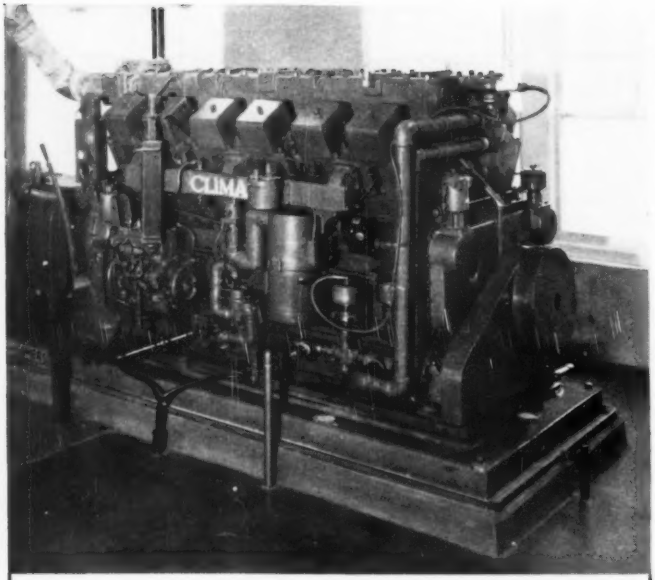
DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT



Climax V-120, 12 Cylinder, Natural Gas Engine @ 900 RPM, direct connected to centrifugal pump requiring 340 H.P. Installed in Water Works, City of Fort Worth, Texas.

climax BLUE STREAK ENGINES

FOR STANDBY OR CONTINUOUS SERVICE

FOUR Climax Blue Streak engines are installed in the Fort Worth Water Works for dependable standby service in case of failure of normal power supply. These engines are on the job constantly to protect Fort Worth citizens by maintaining dependable fire protection and lowering insurance rates. They are used during peak load periods to supplement the motor driven pumps which would otherwise be overloaded or require additional units.

Write for complete information and specifications. There are 4, 6, 8 and 12 cylinder engines, rated from 40 to 600 H.P., operating on natural gas, Butane or gasoline. For operation on sewage gas, engines available in sizes from 40 to 250 H.P.

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Factory and General Office Clinton, Iowa

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Need more facts about advertised products? Mail your Readers' Service card now.

Cathodic Protection System for an Elevated Tank" by H. J. Graeser and E. R. Walker in your November issue. I particularly wish to commend the authors for clearly stating the problem, including adequate discussion and concluding the article with a definite and practical solution to the problem. Too few authors of current informative articles have been able to wrap up the subject as concisely and ably.

1st Lt. John H. Colby, USMCR
Utilities Officer,
Marine Corps Schools,
Quantico, Va.

BOOKS IN BRIEF

TESTING MEASURING EQUIPMENT

This is a 205-page book, written by Ralph W. Smith and published by the Bureau of Standards. It costs $1.25 from the Government Printing Office, Washington 25, D. C. Special consideration is given to the problems of officials charged with responsibilities for weights and measures.

EMERGENCY DEFENSE

The third edition of the Handbook of Emergency Defense Activities lists name, addresses and telephone numbers of all Federal agencies whose functions are devoted in whole or in part to the national defense program. Price 30 cents. Order from Government Printing Office, Washington 25, D. C. Title—Bladeless Trash Pumps

HYDRAULIC STANDARDS

A new section of Hydraulic Institute standards will include data on friction losses in certain types of steel and cast iron pipe for both turbulent and laminar flow; also tabular information on properties of water, friction loss on paper stock and pumping of various liquids. Hydraulic Institute, 122 East 42nd St., N. Y. 17, N. Y.

SURVEYING INSTRUMENTS

The 52nd edition of Gurley's Manual of Surveying Instruments is now available. There are 152 pages, with 85 illustrations. Along with information about good surveying habits, is a lot of information any man who likes a "gun" will enjoy knowing about. $1 from W. & L. E. Gurley, Troy, N. Y.

(*More on page* 16)

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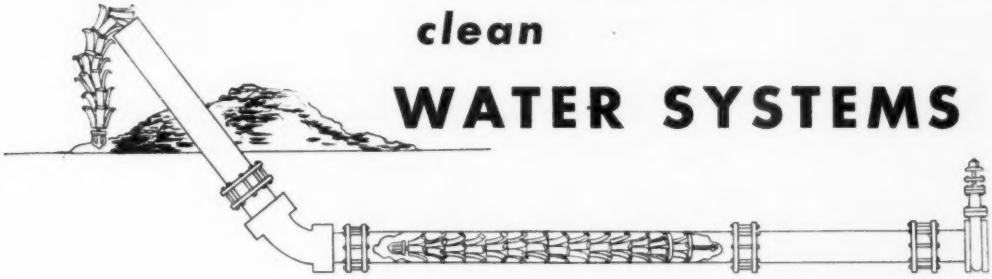
clean WATER SYSTEMS



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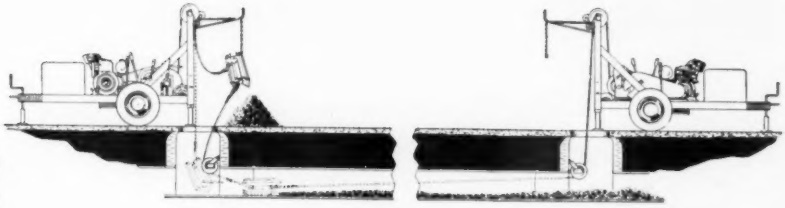
Anywhere
Any Time
Any Size
24 Hours a Day
7 Days a Week

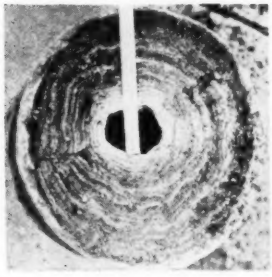


Fast, modern water pipe and sewer cleaning service—that's what ACE Pipe Cleaning Contractors, Inc., offers your city or industry *today,* wherever you are in the United States or Canada!

Preserve your system "for the duration," while pipe and steel are in short supply, with this thorough, economical service.

ACE brings the most modern equipment known to the job, plus trained, skilled crews to get the job done right, quickly and at *lowest possible* cost. ACE has representatives in several principal cities, ready to serve you. Write for further information. Let us send a man, at no expense or obligation to you. Get in touch with us today!

Cleaning jobs done thus far in 1951: Corps of Engineers, U. S. Army; City of Kansas City, Missouri; City of Kansas City, Kansas; Swift & Company; Armour & Company; Cudahy Packing Company; General Motors Corporation; Olathe, Kansas; Belton, Missouri; Milburn Country Club; Council Grove, Kansas; Procter & Gamble Mfg. Company.



Neglected city and industrial water pipes fill with debris like this—cut down service, increase fire rates. Let ACE clean them for you!

✻ Ask to see our new 21-minute newsreel movie of the great Kansas City Flood of July, 1951. No cost or obligation.

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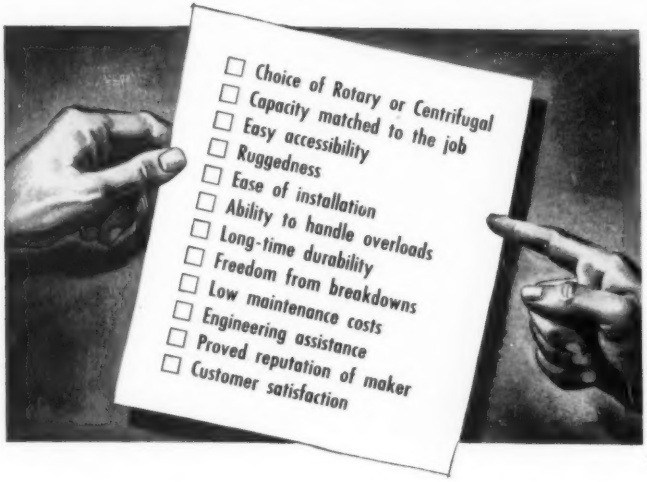
It's a fact . . . our handy Readers' Service card is the easy way to get new catalogs.

BEFORE BUYING *any* BLOWER COMPARE THESE ESSENTIALS



When operation of sewage treatment plants depends so vitally on adequate handling of gas or air, you can't afford to take chances on the performance of your blowers or exhausters. It's better to be safe than sorry.

So, for new installations or replacements, we suggest that you evaluate the equipment by the above standards of comparison. This will help determine the unit that will be most effective, economical and reliable for your specific applications.

Be sure to include the R-C *dual-ability* line of both Centrifugal and Rotary Positive types. Remember, that only we offer you this *dual choice* —with unbiased recommendations from almost a century of experience. With capacities from 10 cfm to 100,000 cfm or higher at moderate pressures, R-C equipment has a long record of outstanding performance in sewage treatment applications.

We'll gladly send detailed information for comparison—or supply engineering help if we can be of service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
521 Poplar Avenue, Connersville, Indiana

CENTRIFUGAL

Motor-driven, 16,000 cfm Centrifugal Blower in large metropolitan sewage treatment plant. Three high-capacity R-C Rotary Blowers are also included in this installation.

Reg. U. S. Pat. Off.

ROOTS-CONNERSVILLE
BLOWER BUILDERS R-C SINCE 1854
ONE OF THE DRESSER INDUSTRIES

Now's the time to mail this month's Readers' Service card.

LEADERS IN THE PUBLIC WORKS FIELD

★

Samuel L. Tolman, Manager of Sales, Sanitary Engineering Division, Jeffrey Mfg. Co., Columbus, Ohio, has been with that firm for sixteen years. Before that time, he had a wide variety of engineering experience, including supervision of the operation of units of New York City's sewage disposal plants. He is a modest gentleman; it took more than a year to get his picture; and the information he gives about himself is painfully inadequate. In the first World War, he was an officer in the Sanitary Corps; and he craved mightily to be back on World War II duty.

He has been primarily responsible for important developments in the sanitary engineering field—the Floc-trol, the Jigrit washer for making grit in sewage nice and clean and usable; and the V-Bucket grit collector. He has made extensive studies on dual disposal of garbage and sewage, and is a recognized authority on that subject.

He was graduated from MIT in 1915 with the degree of BS. He is married; and his hobby and specialty is the growing of dahlias and chrysanthemums. We welcome him with special pleasure to our group of "leaders in the Public Works field."

BOOKS IN BRIEF (Cont.)

WATER SUPPLY & TREATMENT

This is the latest edition of Water Supply & Treatment, published by the National Lime Association, Washington, D. C. It contains 206 pages and sells for $1.25. Order from the Association.

Free EQUIPMENT DATA TO HELP YOUR PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in Engineering and Public Works programs. Just circle numbers you want on the coupon or write the manufacturer direct and mention PUBLIC WORKS.

NEW LISTINGS

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wisc. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

New Data on Gravimetric Dry Material Feeder

228. In a new bulletin, No. 35-F5B, there are full details of the operation and application of the Omega Belt Gravimetric Feeder. This machine continuously weighs and feeds dry materials, with rate accurately controlled by changing belt speeds. Get the bulletin by checking coupon, or write Omega Machine Co., 356 Harris Ave., Providence 1, R. I.

What You Should Know About Design and Use of Concrete Sewers

232. Every engineer and contractor should have a copy of the 48-page book "Concrete Sewers" in his library. This valuable text, published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill., gives an authoritative discussion of hydraulics, sewer design, construction and maintenance. Generous use of illustrations makes the book attractive and helpful to the reader. For your copy, just check the handy coupon.

Get Greater Efficiency on Garbage and Refuse Pick-Up

235. Reduced pick-up costs for garbage and refuse collection are claimed with use of the Quad-O-matic Loader. High-capacity body carries big loads and reduces number of trips to disposal point. Four loading buckets operate independently and distribute load evenly. Hydraulic controls. For more details get bulletin by checking coupon. Equipment Mfg. Co., Dept. PW, 21550 Hoover Rd., Detroit 5, Mich.

How to Build A Sanitary Land Fill

260. Proper use of equipment and the four steps necessary to build a good sanitary fill are shown in an illustrated folder prepared by Drott Mfg. Corp., Milwaukee 12, Wisc. Check coupon today for your copy.

Indicator Solutions and Reagents For pH Control and Water Analysis

236. An attractive four-color catalog lists 180 indicator solutions and reagents for pH measurements and water and chemical analyses with Hellige Non-Fading Glass Color Standards. To insure accurate results and minimize expenses, the components of less stable reagents are furnished separately for use as needed. Get your copy of Catalog No. 600-20 from Hellige, Inc., 37-18 Northern Blvd., Long Island City, N. Y., or check the handy coupon.

What Minerals Are Used For Water Treatment?

267. Basic data on the filter materials, zeolites and other minerals used in water conditioning will be found in a new bulletin "Minerals For Water Treatment," issued by General Filter Co., Ames, Iowa. All engineers and water works men will want a copy. For yours, just check the coupon.

Choosing Trucks For Municipal Service

264. For all municipal services, trucks are needed that are high in efficiency and economy. Be sure to investigate the White 3000, engineered for high performance. Full details on White Super Power trucks from the White Motor Company, Cleveland 1, Ohio.

Heavy-Duty Loading Machine Speeds Highway Cleanup

265. An attractive folder with full-color illustrations shows the Eimco Rocker-Shovel at work on heavy highway cleanup jobs where rock slides had blocked the road. Specifications and other details are furnished on this economical, rugged loading machine. Check coupon or write The Eimco Corp., Salt Lake City 10, Utah.

How to Paint Swimming Pools

266. A check list of the requirements for good swimming pool paints, and details of the proper painting methods for new and old pools are furnished in a helpful folder, available from Steelcote Mfg. Co., St. Louis 3, Mo. Get your copy of this useful folder by checking the coupon.

Cushioned Valve Protects Water Line

261. Surges in water systems which cause excessive pressures may be controlled by installation of a water pressure relief valve. Engineering details on surge-relief valves are given in Bulletin W-2, issued by Golden-Anderson Valve Specialty Co., 207 Keenan Bldg., Pittsburgh 22, Pa. For your copy, check coupon today.

Absorbing Shock On Bucket Loaders

262. Severe shock and vibration of hydraulically operated bucket loaders, power shovels, and similar equipment may be controlled by a Greer Hydro-pneumatic Accumulator. Engineering details on impact effects and cures in Bulletin 700, available by checking coupon. Greer Hydraulics, Inc., 454 18th St., Brooklyn 15, N. Y.

Civil Defense Protective Equipment

251. The protective equipment and accessories needed by all civil defense workers are shown in a new 28-page bulletin issued by Mine Safety Appliances Co., Pittsburgh 8, Pa. Detailed breakdowns show requirements for each type of service, and a convenient table of equipment helps in determining a community's needs. Check coupon for your free copy.

"Compressed Air Power In Construction"

259. In a new booklet of this title, the Compressed Air and Gas Institute, 1410 Terminal Tower, Cleveland 13, Presents a helpful discussion of the wide applications of compressed air power in the construction industry. Use of all types of tools aand equipment are illustrated and described in considerable detail. Your copy of this valuable pamphlet available by checking the coupon.

Gauges for Good Filter Plant Operation

275. Mechanically operated filter gauges for indicating and recording loss of head, rate of flow, sand expansion and other data needed for good filter plant operation, are described in Bulletin No. 450-H10, issued by Builders-Providence, 356 Harris Ave., Providence 1, R. I. Besides details on the gauges themselves, typical installations are shown. Check coupon for your copy.

MORE LISTINGS ON PAGES 18 TO 23

Clip AND MAIL TODAY

READER'S SERVICE DEPT. PUBLIC WORKS MAGAZINE 310 East 45th Street, New York 17, N. Y.

Please send me the following literature listed in the Reader's Service Dept. of your January issue.

Booklets from pages 17 to 23:

20	23	25	30	33	34	37	44	46	49	53	55	65	69	71	76	77	78	80
84	94	95	99	101	102	103	106	109	113	114	122	125	134	135	137	138	144	149
150	151	153	158	166	169	173	175	176	177	179	183	186	187	191	192	194	195	201
202	209	213	214	220	224	227	228	232	233	235	236	251	255	256	259	260	261	262
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New Products, pages 83 to 86:

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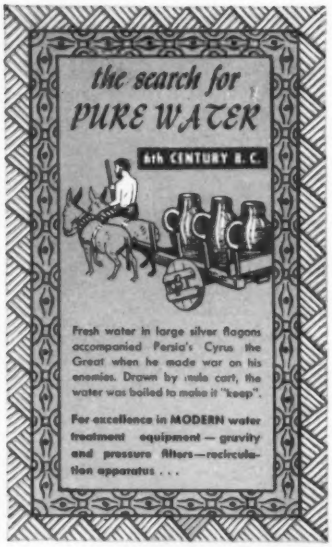
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Fresh water in large silver flagons accompanied Persia's Cyrus the Great when he made war on his enemies. Drawn by mule cart, the water was boiled to make it "keep".
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Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band—at spigot by hard vulcanized gasket tip.

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Check Coupon on page 17 to order this FREE EQUIPMENT DATA

Maintenance Guide Helps "Cat" Users

268. A new, cartoon-style Maintenance Guide shows how to follow good maintenance practices for the smaller size "Cat" diesel engines and electric sets. Fuel systems, lubrication, cooling, intake and exhaust systems are covered in easy-to-read fashion. Check the coupon for a copy. Caterpillar Tractor Co., Peoria 8, Ill.

Incinerator Arrangements and Mechanical Stoking Data

269. Typical layouts for single and duplex incinerator units, and a full discussion of details of the mechanically stoked incinerator will be found in new Bulletin 111-B, issued by Morse-Boulger Destructor Co., New York 17, N. Y. Check the handy coupon for your copy.

Snow Fighting Instruction Bulletin

270. Equipment requirements and plan of attack are outlined in a new Snow Fighting bulletin issued by Walter Motor Truck Co., Ridgewood, Queens, L. I., N. Y. Included are special considerations for light, normal and deep snows, plus a check list of special precautions. Copies available by checking the coupon.

CIVIL DEFENSE

Air Cooled Engines for Hundreds of Applications

137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power of hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

Protection Against Power Failure

169. Data on stationary, portable, and standby electric plants, AC and DC, are offered by D. W. Onan & Sons, Inc., 7657 University Ave., Minneapolis 5, Minn. Several bulletins cover diesel and gasoline-driven plants for every purpose. Just check the coupon for your copies.

Emergency Chlorination and Main Sterilization

213. Get data on portable emergency chlorination units designed to save time in cases of broken mains or substitute water supplies. Use coupon to order copies of publications 22-C; 58-C; and 408 from Wallace & Tiernan Co., Newark 1, N. J.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co. 208 So. La Salle St., Chicago 3, Ill.

STREETS AND HIGHWAYS

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Get Data Now On This Catch Basin Cleaner

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

Aerial Surveys and Maps from Photographs

53. Written in non-technical language, a 16-page booklet with this title gives a complete explanation of aerial surveys for the municipal field. Interesting step-by-step pictures show how planimetric and topographic maps, mosaics and atlas sheets are produced by Abrams Aerial Survey Corp., Lansing 1, Mich. Check the coupon for your copy.

Spreaders for Ice Control Save Labor and Speed Job

103. Only the driver is needed to spread salt or abrasives for ice control when a Flink Tail-Gate Spreader is used. Hydraulically driven, fully automatic unit is controlled from the cab. Further details in bulletin issued by The Flink Co., Dept. 11-S, Streator, Ill. Use coupon today.

Reference Manual on Guardrail Design

114. Here is an interesting and informative booklet in which all factors influencing guardrail design are outlined, and safety and economy discussed in detail. Eight pages are devoted to basic design data, with handy tables covering physical properties, tensile and beam strengths, deflection and other data. Write Armco Drainage and Metal Products, Inc., Dept., PW, Middletown, Ohio.

Eliminate Hazard of Loose Gravel on Roads

125. Accidents caused by loose gravel can be checked and costly gravel loss reduced by proper stabilization of your gravel roads. Investigate the low-cost stabilization and gravel salvage methods offered by the Seaman Pulvi-Mixer. Bulletin "Stabilize Gravel Roads" is well worth studying. Check the coupon today. Seaman Motors, Inc., 305 N. 25th St., Milwaukee 3, Wis.

Black-Top Paver Offers Many Advantages

150. The flexible Adnun Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foote Co., 1954 State St., Nunda, N. Y.

Versatile Maintainer Has Year 'Round Usefulness

151. A new bulletin shows how the sturdy Huber Maintainer will work for you the year 'round on maintenance jobs, berm leveling, road planing, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

Snow Plows for Every Street and Highway Need

227. In a new bulletin, No. 51-F, full details are given on the Frink reversible trip-blade "Sno-Plow", which has special design features to eliminate chatter and to permit quick adjustment to nine plowing positions or scraping position for ice removal. Check the coupon for your copy. Frink Sno-Plows, Inc., Clayton, N. Y.

Heating, Thawing and Melting With Hauck Burner Equipment

277. A helpful 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. For a useful addition to your reference file, get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

Fast Mowing in Hard-to-Reach Places

279. The lightweight, power driven Sythette cuts smoothly in rocky, hard-to-reach places; does the job 4 times faster than ordinary methods. Illustrated folder offered by Hoffco, Inc., Richmond, Ind. Get your copy by using coupon.

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REFUSE COLLECTION AND DISPOSAL

A Working Plan for Community-Wide Garbage Grinding

30. In a descriptive booklet "Community-Wide Garbage-Free Living" a sound working plan is outlined for the installation of garbage grinders to eliminate the headaches of garbage collection and disposal, yet at the same time relieving the public officials of difficult financing problems. Get your copy from Given Mfg. Co., Dept. PW-8, 1250 Wilshire Blvd., Los Angeles 17, Calif. Use the coupon today.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 1291 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

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SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, % Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new SewerRodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

Check This Service When Building Water or Sewage Plants

65. Experienced engineers and craftsmen of Municipal Service Company can help you by furnishing and installing mechanical equipment and piping for water and sewage plants. Nation wide service is available. Get full information on your current jobs by writing Municipal Service Co., M-1, 908 Grand Ave., Kansas City, Mo., or use the coupon.

Designing Grit Chambers? Here's What You Should Know

113. A helpful bulletin filled with drawings of typical designs, operating data, clearly written text outlining the principles of grit chamber design and requirements for removal of grit free from oganics is offered by the Dorr Company. Get your copy of Bulletin 6411 on the Dorr "Detritor" by checking the coupon or from The Dorr Co., Barry Pl., Stamford, Conn.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connersville Blower Corp., 510 Poplar Ave., Connersville, Ind.

Sewer and Water Pipe Cleaning Service Can Save You Money

149. Your sewers and water pipes will be cleaned by experienced crews using modern, mobilized equipment when you take advantage of the fast, efficient service offered by Ace Pipe Cleaning Contractors, Inc., Kansas City, Mo. Don't neglect proper sewer sanitation or clogged water lines; let specialists do the job for you. Make a start today by getting the profusely illustrated bulletin which describes the Ace services. Check the coupon now.

How Cities Clean Sewer Lines From Street in One Operation

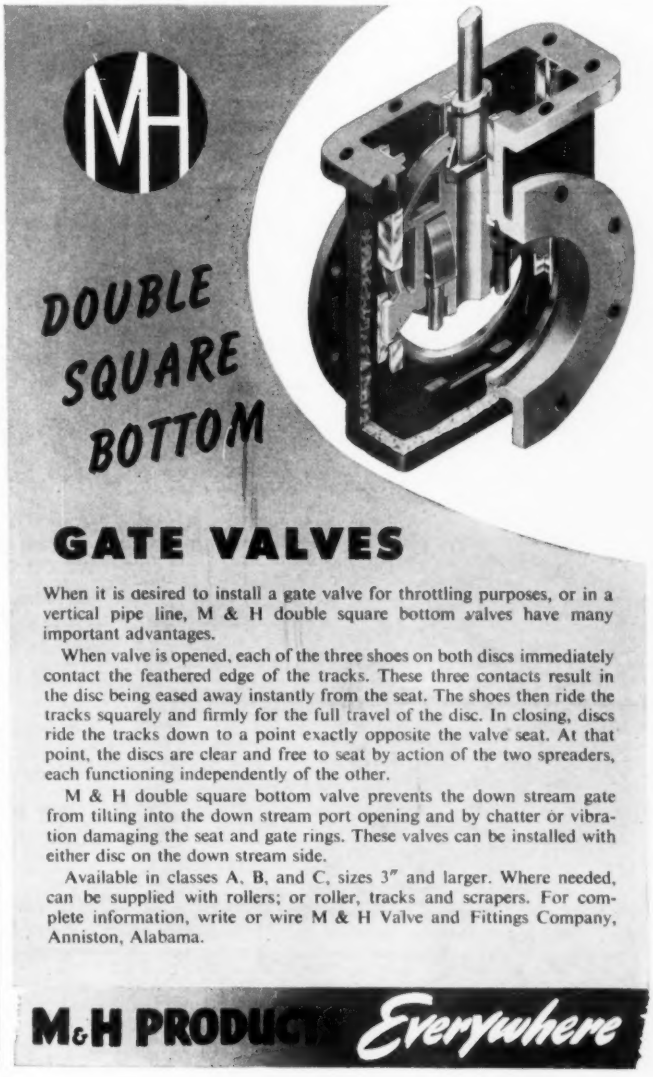
25. In a helpful 28-page handbook of sewer cleaning methods and equipment the makers of OK Champion sewer cleaners give full details of power and hand operated models. Also included are data on expansion buckets that take dirt from sewer to street in one operation, root cutters and other accessories. Get your copy by checking coupon. Champion Corp., 4752 Sheffield Ave., Hammond, Ind.

Air for Activated Sludge and Other Aeration Processes

187. Quiet operation, high efficiency and compact size are features of the Chicago "Standardaire" positive displacement blower. Wide range of capacities available to fit your needs. Details and performance data from Chicago Pump Co., 2348 Wolfram Ave., Chicago 18, Ill.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog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Available in classes A, B, and C, sizes 3" and larger. Where needed, can be supplied with rollers; or roller, tracks and scrapers. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
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853. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-H16. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts and shafting selection. Copies available by using coupon or from Worthington Pump and Machinery Corp., Harrison, N. J.

Data on Design of Grit Collectors and Washers

202. Grit collection and separation of organic materials from settled grit is described in Link-Belt Bulletin 1942. Typical installations are shown, and design data is provided, together with specifications. Use coupon for copy, or write Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

How Vacuum Filters Help Your Sewage Sludge Disposal

209. Applications of the Conkey sludge filter to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give anticipated average results. Use the coupon to order your copy. General American Transportation Corp., Process Equip. Div., New York 17, N. Y.

Sewage Screening and Cutting with the Griductor

233. How the Griductor operates, construction details, and dimension and capacity data are given in Bulletin 5100. Special features include double ended cutter teeth which are readily resharpened. For your copy, write to Infilco Inc., Box 5033, Tucson, Arizona or use the handy coupon.

CONSTRUCTION EQUIPMENT AND MATERIALS

Handbook of Contractors Pumps Is Easy to Use

49. Big 50-page Catalog P-10 covers dewatering pumps, pressure pumps, well point systems and electric pumps, and also features a special section of useful data which helps in the selection of the right pump for your job. Every construction engineer and contractor should have a copy of this valuable handbook. Just check the coupon. The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts" a new illustrated booklet prepared by The Oliver Corp., that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio.

Tractors for Counties, Cities and Contractors

76. An attractive 24-page catalog portrays the Allis-Chalmers HD-5 crawler's abundant capacity and ability to meet the variable needs of counties, townships and contractors. Photographs and cutaway views illustrate its rugged construction and simplified maintenance. Use coupon or write Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wisc.

3 to 5 Ton Tandem Roller Has Many Uses

84. The Galion Iron Works & Mfg. Co., Galion, Ohio, has just issued a catalog on their new model 3-5 ton Variable Weight Tandem Roller. The many improvements in construction and operation are fully described and illustrated. Get your copy of Catalog 360 by checking the coupon.

Safety Lantern With Pencil Beam Signal

77. Get information on the Dietz "Night Watch" Safety Lantern with special globe design that saves fuel by intensifying light rays into a pencil beam. Full details available from R. E. Dietz Co., Syracuse, N. Y. Just check the handy coupon.

Forms for Every Concrete Pipe Shape

95. In addition to this a complete line of forms for standard concrete sewer and drainage pipe, special forms for varied shapes of every type are listed in the Quinn Concrete Forms Catalog. Copies available by checking the coupon, or write direct to Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Examining a Tractor Piece by Piece

99. The new 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Special Pumps to Fit Any Dewatering Job

101. Centrifugal Pumps. Long lasting, self-priming, non-clogging pumps for quickly dewatering trenches and similar construction jobs. Ask for Bulletin 7-LW-13. Gorman-Rupp Co., 520 No. Bowman St., Mansfield, Ohio.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Newark, N. J. Uses NETCO *To Clean Catch Basins*

PERFORMANCE is reason enough why many of the largest cities own one or more NETCO CATCH BASIN CLEANERS.

John Vacchiano, Newark road superintendent, sasy this: "In a peak day we have cleaned as many as 50 catch basins with our NETCO.

"After a recent record storm our NETCO more than proved itself in the many cases of emergency that resulted from debris washing into sewers. We're completely satisfied with our NETCO."

THE NETCO WAY IS THE MODERN CHEAP WAY OF CLEANING CATCH BASINS

Fill in and mail this coupon TODAY for complete information on NETCO CATCH BASIN CLEANERS ➡

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TITLE .....

ADDRESS .....

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NETCO DIVISION
CLARK-WILCOX COMPANY
118 Western Avenue
Boston 34, Massachusetts

Check "Gunite" Concrete For Every Application

158. Big 44-page book illustrates "Gunite" uses for both repair and new construction of sewers, tanks, dams, swimming pools, and all concrete structures. A multitude of applications. Be sure to check coupon or write Pressure Concrete Co., Dept. PW, 315 S. Court St., Florence, Ala.

Your Property is Worth Good Protection

176. When installing link fence you want protection against rust and corrosion as well as vandalism. Investigate chain link fence made of "Konik" metal described in "Planned Protection" published by Continental Steel Corp., Kokomo, Ind.

Combination Overhead And Front-End Shovel

194. The "Lodover", described in Bulletin LO 200, is a combination overhead and front-end shovel for International T-9 and TD-9 tractors. By digging in front, swinging load overhead and dumping to the rear, extra yards are handled every hour. Regular front-end loading is not impeded in any way. Service Supply Corporation, 2004 Erie Ave., Philadelphia 32, Pa. Check handy coupon.

Helpful "How To Use" Section Aids Roller Selection

195. In addition to specifications and illustrations of roller operation, the new Buffalo-Springfield catalog features a special section to help in the selection of the right roller model for the job. Be sure you get top results from your roller selection by checking this helpful material. Use the coupon for a copy. Buffalo-Springfield Roller Co., Dept. Q-7 Springfield, Ohio.

Gunite Costs Less On Repair Jobs

255. Be sure to investigate Gunite for repair of reservoirs, dams, water and sewage plant tanks, sewers, swimming pools, etc. Contact Eastern Gunite Co., Elkins Park, Pa. for full information, or use coupon.

WATER WORKS

Is Your City Metered 100%

33. 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

Engineering Data on Diatomite Filters

44. Detailed information and typical plans of Sparkler diatomite filters for swimming pools of municipal water systems is available to engineers and municipal officials. These filters feature self-cleaning filter elements which cut wash water to a minimum. Get this material now by using coupon. Sparkler Manufacturing Co., Mundelein, Ill.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

96 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. A 96 page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

All Electric Floatless Liquid Level Control

78. Description of operating principles and applications of B/W controls shows the simplicity and many uses of these all-electric, floatless devices. Diagrams of typical installations and engineering data all in bulletin 147 issued by B/W Controller Corp., Dept. PW, 2224 E. Maple Rd., Birmingham, Mich.

Factors to Consider in Elevated Tank Selection

80. An interesting discussion of the factors to be considered for selection of elevated capacities and sizes, required fire flows and other useful data are included in a bulletin on elevated water storage published by Pittsburgh-Des Moines Steel Co., Neville Island P. O., Pittsburgh 25, Pa.

Painting Water Tanks For Longer Protection

94. High labor costs demand special consideration when painting elevated water tanks. This and other factors involved in proper paint selection are discussed in a bulletin issued by Jos. Dixon Crucible Co., Dept. 12P, Jersey City 3, N. J. Helpful specifications for repainting water tanks are also included.

Tested Jointing Materials

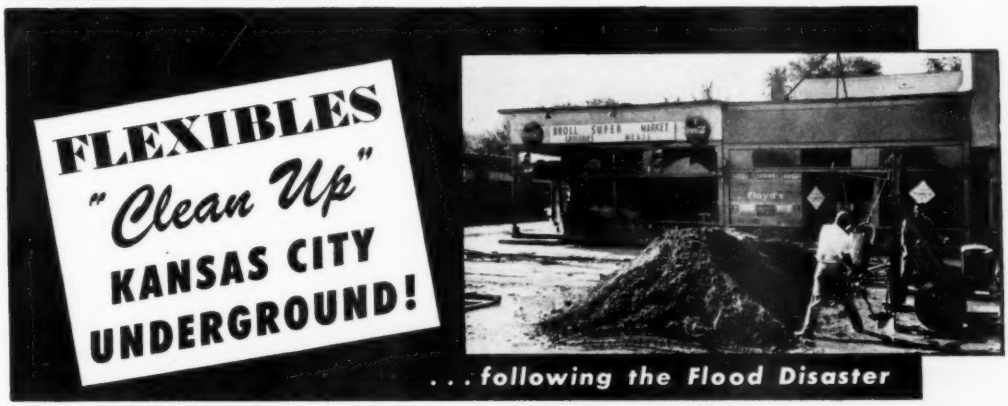
102. "Hydrotite" is a self-caulking, self-sealing joint compound for bell and spigot pipes. For data book and sample write Hydraulic Development Corp., 50 Church St., New York, N. Y.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.



30 "FLEXIBLE" power bucket machines have been working in the Kansas City flood area since August! This is no doubt America's ***all-time-biggest*** sewer cleaning job. To aid the stricken area quickly, many cities from as far away as Ohio, Minnesota and Texas made their "FLEXIBLE" equipment available under "FLEXIBLE" supervision, in addition to those immediately supplied by the factory.

America recognizes "FLEXIBLES" with the Red Cross and National Guard as essential in emergencies.

Write for FREE DATA to Dept. P

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UNDERGROUND PIPE CLEANING CO.
SEWER-ROD EQUIPMENT CO.
9055 VENICE BOULEVARD, LOS ANGELES 34, CALIF.

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200 Magee Bldg. — Pittsburgh, Penn.
66 Kiniry Drive — Rochester 9, New York
29 Cerdan Avenue — Roslindale 31, Mass.
801 E. Excelsior Blvd. — Hopkins, Minn.
3786 Durango St. — Los Angeles 34, Calif.
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Francis Hankin — Montreal & Toronto, Can.
351 West Jefferson Blvd. — Dallas, Texas

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS & EQUIPMENT

WATER WORKS (Cont.)

How Elevated Water Tanks Can Save on Operating Costs

134. Beautiful new booklet on Horton elevated steel water tanks suggests ways to reduce pumping costs, increase capacity of systems, maintain uniform pressure, etc. Illustrates 7 models of welded, ellipsoidal-bottom, elevated steel tanks in full color. Write Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4, Ill.

Helpful Data on Mechanical Joints

138. Get Circular 49 from M & H Valve & Fittings Co. for important information and installation dimensions of M & H AWWA Mechanical Joint Valves and Hydrants. Features include ease of installation, construction economy, long life. Use coupon or write M & H Valve & Fittings Co., Anniston, Ala.

Pollution-Proof Outdoor Drinking Fountain

144. A new outdoor drinking fountain so designed that contamination by cross connections or back siphonage is not possible is fully described in a 4-page bulletin. Features neat appearance, easy installation. Write Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio, or use coupon.

Rehabilitation for Your Water System

153. Whether your water supply system requires a complete rehabilitation program including an engineering survey, hydraulic analysis, reconditioning and related construction, or merely pipe cleaning and coating, it is wise to plan your campaign without delay. Get full data now on the requirements to put your system in top condition. Write Pittsburgh Pipe Cleaner Co., 133 Dahlem St., Pittsburgh 6, Pa., or check handy coupon.

Gallons- NOT GUESSES!

BUILDERS *Propeloflo*--

the ideal propeller-type meter for measuring the *actual* flow of water in pipelines 2" to 36" and larger.

FEATURES

High Accuracy and Wide Range, measuring within ± 2% of actual flow from about 10% to 100% of rated capacity.

"Open Upper Limit", temporary overload range of 150% of rated capacity.

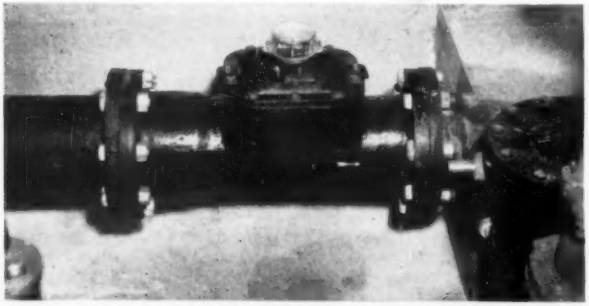
As Easy to Install as a valve or fitting.

Low Loss-of-Head, lower than most other types of flow meters.

Secondary Instruments, cable driven or electrically operated, for Totalizing, Indicating and/or Recording flow at nearby or remote locations.

Intermittent Service, where the line occasionally drains dry, Propeloflo registers accurately, without attention, when flow is resumed.

For complete information and Bulletin 380-G2A, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 356 Harris Ave., Providence 1, Rhode Island.



B-I-F INDUSTRIES **BUILDERS-PROVIDENCE** BUILDERS

Instruments for recording, indicating, and controlling flow, liquid level, pressure, and weight. Chlorinators — chlorine gas feeders.

Helpful Data on Well Water Systems

173. A comprehensive, 48-page book on Layne Water Well Systems covers gravel wall wells, underreaming, cemented walls, rock wells and other well types. Applications of shutter screens and vertical turbine pumps are shown, together with water treatment and conditioning equipment. Ten pages are devoted to useful engineering tables and measurement data. Check the coupon today or write Layne & Bowler, Inc., Dept. PW, Memphis 8, Tenn.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

How to Design Chemical Feed Systems

179. In a 12-page booklet published by Proportioneers, the many factors which enter into the design of a chemical feed system are discussed, and the types of systems used described in detail. These include dry feed, both volumetric and gravimetric and solution feed of the decanter and positive displacement pump types. Feeder controls are considered in detail. Send now for File No. RP-9080 by checking coupon. Proportioneers, Inc., Providence 1, R. I.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All Waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Installation Guide for Transite Pressure Pipe

192. A conveninent, pocket-size book of 115 pages covers the whole job from receiving and handling pipe to pressure and leakage tests of finished lines. Over 100 drawings show important operations, and the text tells both how and why. Copies are available from Johns-Manville, Dept. PW, 22 E. 40th St., New York 16, N. Y.

Insurance Benefits For Civil Employees

256. Civilian government employees are offered insurance protection at the lowest possible cost by Government Employees Insurance Companies, Gov't Employees Insurance Bldg., Washington 5, D. C. Full details available by checking the coupon.

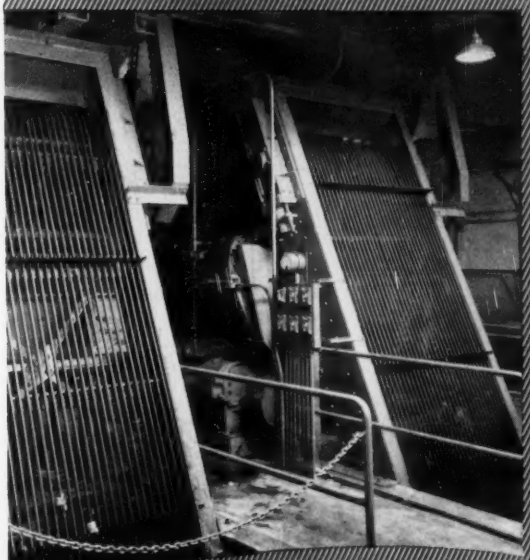
How to Compute Quantities of Jointing Materials

271. A helpful table for determining quantities of "Tegul-Mineralead" required, using jute or "Hyde-Ro Rings", plus complete answers to your questions on sulfur compound jointing materials will be found in Bulletin M-10 issued by Atlas Mineral Products Co., Mertztown, Pa. Check the handy coupon today.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Burlington, N. J. Get your copy by checking the coupon.

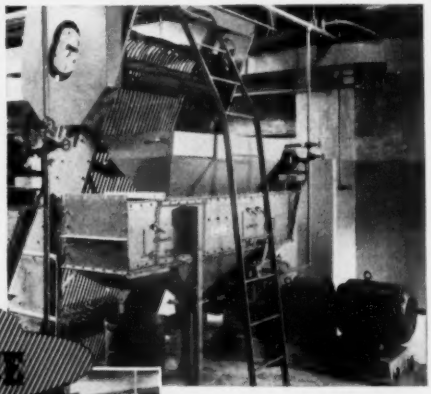
IMPROVED BACK-CLEANED SCREENS



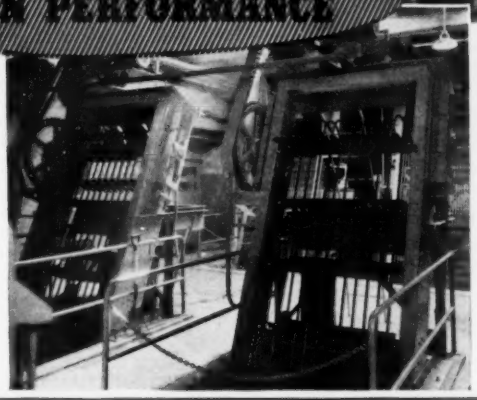
OVER 10 YEARS PROVEN PERFORMANCE

Jeffrey pioneered in the development of the Back-cleaned Screen—has over ten years of experience in the design and building of this type of mechanization.

It is available in either inclined or vertical position—is highly recommended for all difficult screening problems, whether the plant is small or large. It is fool-proof. Dozens of installations prove its dependability and low maintenance.



Above—rear view of the Fine Screens (upper left) in the 26th Ward Plant showing Jeffrey Belt Feeder and Screening Grinder.



Two of four fine Screens installed in the 26th Ward Sewage Treatment Works, New York City. Right—one of four coarse heavy duty Screens at the same plant.

Also:

SLUDGE COLLECTORS
SLUDGE ELEVATORS
FLOCTROLS
GRIT WASHERS
GRIT COLLECTORS
BAR SCREENS
RAPID MIXERS
GRINDERS
CHEMICAL FEEDERS
CHAINS

Many plants—both water, sewage and industrial—are being served by Jeffrey equipment. Names furnished upon request.

Send for Catalog No. 833

THE JEFFREY MANUFACTURING COMPANY
947 North Fourth St., Columbus 16, Ohio
ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

Jeffrey Mfg. Co. Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
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The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio

1 USE TFF INSTITUTE SPECIFICATION UNDERDRAINS

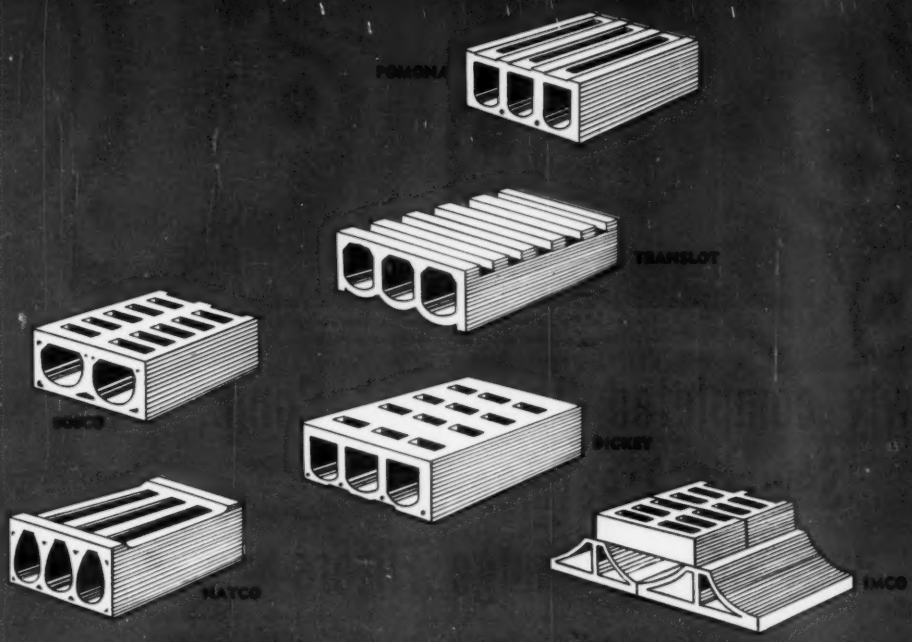
The scientific design of these *vitrified clay filter bottom blocks* insures trouble-free operation for the life of the filter. They have large top openings. That means proper ventilation of all filter media and free discharge of the filter effluent at all times. They have smooth run-off channels. That means quick drainage and no clogging. The blocks are light in weight, self-aligning and easy for unskilled labor to lay. After they have been laid they are strong enough to work on and to support even very deep filter media.

These modern underdrain blocks will carry applications up to 50 MGAD. They are best for all kinds and shapes of filters. They are used everywhere better operating results are desired.

Use them to insure best results from your next trickling filter. Give it a *specification* floor. Use TFFI *vitrified clay filter bottom blocks*. For full engineering details write any member of this Institute today.

Need more facts about advertised products? Mail your Readers' Service card no

Trickling Filter Results



2 USE GOOD EQUIPMENT

We cannot urge you too strongly to insist on good equipment to go with the *specification* floor. Both are important in every trickling filter. So work with one of the leading makers of this kind of equipment. The benefits of their long experience and extensive research in sewage treatment are yours for the asking. Always remember this: top quality results demand top quality equipment . . . and a *specification* floor.

TRICKLING FILTER FLOOR INSTITUTE

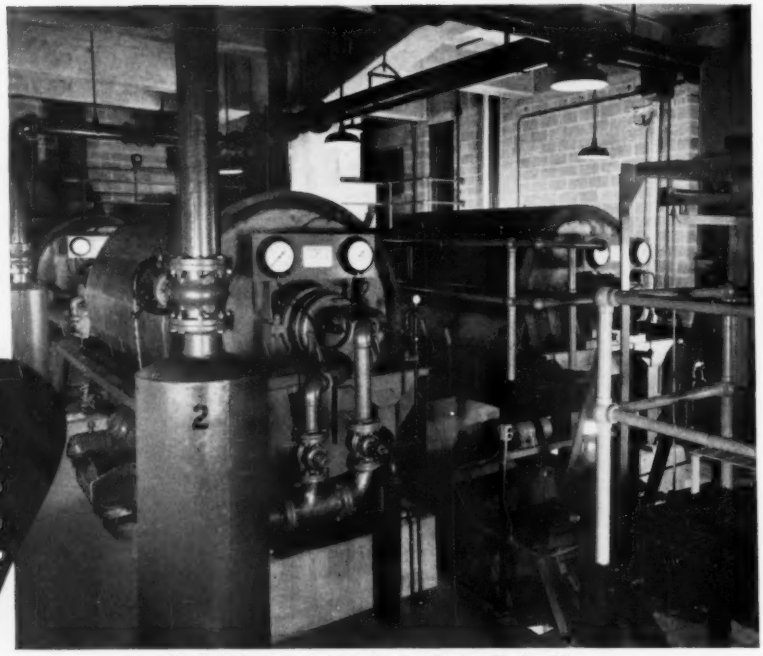
Pomona Terra-Cotta Co. Pomona, N. C.
W. S. Dickey Clay Mfg. Co. Kansas City 6, Mo.
Ayer-McCarel-Regan Clay Co. Brazil, Ind.
Bowerston Shale Co. Bowerston, Ohio
Industrial Materials Co. Philadelphia 34, Pa.
Texas Vitrified Pipe Co. Mineral Wells, Tex.
National Fireproofing Co. Pittsburgh 22, Pa.

It's a fact . . . our handy Readers' Service card is the easy way to get new catalogs.

See General American for

CREATIVE FILTER ENGINEERING

Designed to do your job best!



Section of the filter room showing Conkey Sludge Filters in recently opened Bridgeport primary treatment plant.

Newly completed Bridgeport, Conn., Sewage Treatment Plant uses Conkey Sludge Filters

Bridgeport's new East Side primary treatment plant handles a high percentage of diversified industrial wastes. Careful planning plus several unique innovations were required to successfully dewater and incinerate this sludge. It was essential that the sludge filters . . . *heart of any sewage treatment plant* . . . would dewater rapidly, continuously and automatically at the lowest possible cost. Conkey Sludge Filters were selected and have provided *better filtration* . . . fulfilling each necessary requirement perfectly.

Typical Conkey Sludge Filter features are the effective plastic backing plates for filter cloth support, the Uscolite pipe lines and drainage bells, the efficient double scraper arrangement, specially formulated protective coatings and many newly developed components made of special plastics.

Bridgeport, Chicago, many other cities . . . private industry in many places . . . all have found that creatively engineered Conkey Sludge Filters "do a better job" and do it at minimum cost. Bulletin No. 100 on Conkey Filters belongs to every progressive sewage engineer. Write for your copy today.

Other General American Equipment:
Turbo-Mixers, Evaporators, Thickeners, Dewaterers, Dryers, Towers, Tanks, Bins, Pressure Vessels

OFFICES IN ALL PRINCIPAL CITIES

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Now's the time to mail this month's Readers' Service card.

MOBIL-SWEEPER AND ITS DEALERS

THANK THE PUBLIC OFFICIALS

148 MOBIL-SWEEPERS ORDERED & DELIVERED IN 1951

Mobil-Sweeper's Family of Dealers Extend Greetings For 1952

and advises early purchases of your anticipated requirements for street sweeping equipment because materials control can quickly alter production and delivery schedules.

Your sweeping budget will go farther when your city is equipped with Mobil-Sweepers. Operating under all conditions, Mobil-Sweeper is *unexcelled* in sweeping ability. Add to this the extra advantages of lower maintenance plus greater safety to drivers and you know why there's an ever-increasing demand for this sweeper.

CONSIDER ALL THE SAVINGS—Whether you use the central dumping system or haul refuse directly to the dump, Mobil-Sweeper's extra speed (travels at top legal speeds when not sweeping) re-reduces "dead-heading" time between sweeping area and dump. Less time is spent traveling from service yard to sweeping area.

LOWER MAINTENANCE COSTS—Because Mobil-Sweeper is built on a modified International Harvester Truck chassis, your regular maintenance methods and equipment for trucks is applicable to this sweeper. Here is a major saving in upkeep and your costs are materially reduced on specially designed parts and tools.

WHY A SAFER SWEEPER PAYS OFF—Even a slight injury is costly. That's why Mobil-Sweeper provides a heavy steel cab on every sweeper. The driver is protected from low hanging branches...he's protected by shatterproof windshields in accordance with safe driving methods. Visibility is better—no blind spots out front. Four-wheel hydraulic brakes assure safe stops even when sweeper is fully loaded. And all-weather comfort is afforded by the cab.

MOBIL-SWEEPER IS EASY TO MANEUVER—For effective sweeping, no full-size sweeper will out-maneuver a Mobil-Sweeper. It gets in and around parked cars with complete ease and clean sweeping . . . sweeps clean on sharp curb returns, up and down hills.

Your Community Will Find Mobil-Sweeper Best All Ways!

MOBIL-SWEEPER
DIVISION OF
THE CONVEYOR CO.
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LOS ANGELES 58, CALIF.

CONVEYCO

THE CONVEYOR COMPANY
3260 East Slauson Avenue, Los Angeles 58, Calif. PW-12

Gentlemen:
Please send catalog with complete details and specifications for the Mobil-Sweeper.

Name _____ Title _____

Address _____ City _____

County _____ State _____

Get full details of this month's new products . . . mail your Readers' Service card today.

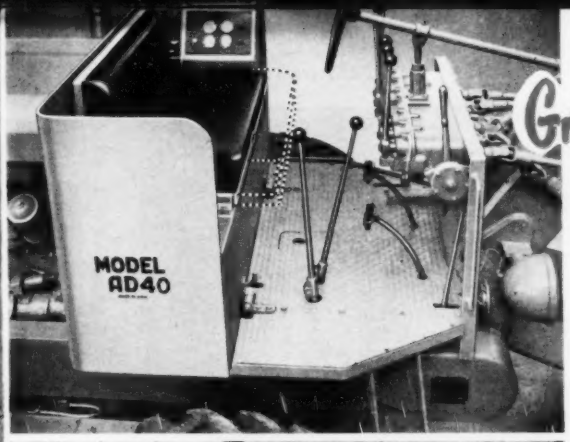
NOW! a Great New HEAVY-DUTY GRADER

Allis-Chalmers AD-40

Weight — 23,000 lb.
(24,800 lb. with optional calcium chloride in tires)

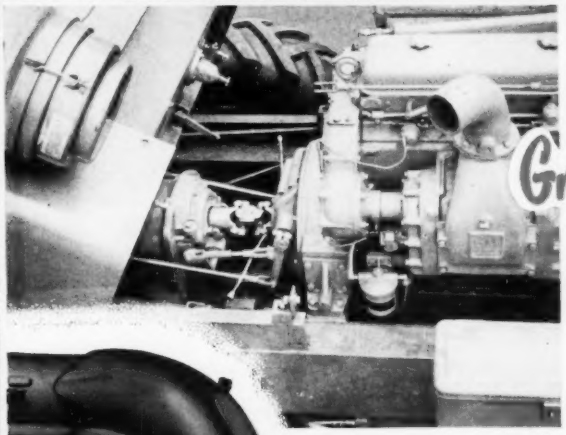
104 Brake hp.

Built to handle All Jobs — FASTER, EASIER



Great New operating ease

No other grader has been designed with the operator more in mind. **Unmatched Visibility**—Single tubular frame from front to platform, new lift cases, low control box and tapered platform give operator a full view of what he is doing. **Feather-Touch Steering**—New hydraulic booster system, fully enclosed in the frame, provides effortless steering with positive control even under toughest conditions. **All-Around Comfort**—Roomy platform, adjustable seat (as shown) and simple controls offer any size operator true comfort—sitting or standing.



Great New service simplicity

Here's maintenance and repair accessibility second to none. Combined fuel tank and seat unit tilts forward for easy access to clutch, transmission and drive shaft. Transmission can be removed without disturbing floor plates. Power take-off and hydraulic pump are mounted outside the dash.

Great New performance

Add these outstanding operator and service advantages to the exclusive Allis-Chalmers features that include ROLL-AWAY* Moldboard—extra high clearances from front to rear—shock-absorbing tubular frame—dependable General Motors 2-Cycle diesel power . . . and you have the finest heavy-duty grader on the market. Get the full story on this new AD-40 from your Allis-Chalmers dealer now.

*ROLL-AWAY is an Allis-Chalmers Trade-mark.

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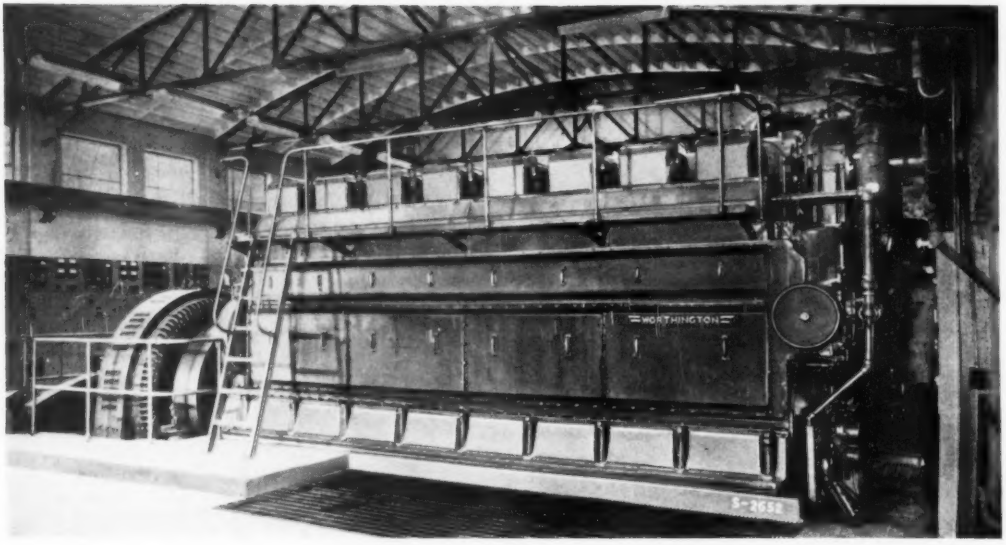
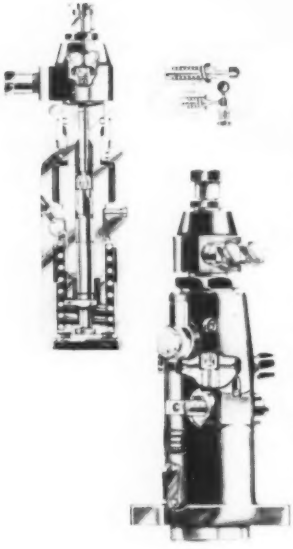
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

• Designed for Your Job • Built to Take It • Easy to Operate • Easy to Service



This Diesel Is Ready

FOR A CHANGE IN DIET



Worthington-designed dual plunger fuel pump.

Right now this Worthington Diesel—one of three 1760 hp units owned by the city of Tarboro, N. C.—is operating on oil.

But they anticipate natural gas in this area, and this Diesel is ready for it. With slight changes, it can easily be converted.

Worthington-designed dual plunger pumps now completely fuel this engine with oil—producing more perfect atomization, making possible the use of a *heavier* grade of oil. Also: firing pressures are reduced, exhaust temperatures, too, and combustion is improved.

When the conversion to gas is made, the dual plunger pumps will furnish pilot oil for ignition. Conversion is made quickly and at low cost.

For any engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

Only Worthington dual fuel engines offer such exclusives as dual plunger pumps, gas micro-metering valves for each cylinder, and automatic thermal air control—all built to give optimum performance for the fuel used.

Write for Bulletin S-500-B 31 C, Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

WORTHINGTON

ENGINES

E.1.12

ECONOMICAL CONTINUOUS POWER

Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

WORTHINGTON-BUILT AUXILIARIES

Engine Starting Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Coolers

Plano, Illinois built 102,000 sq. yds. of dustless all-weather city streets for $22,275. The materials used, gravel, sand and SC-3 asphalt, were mixed in place by the SEAMAN MIXER.

Akron, Ohio street officials estimate that the SEAMAN MIXER has saved the municipality thousands of dollars in the construction and maintenance of 400 miles of city streets.

OVER 100 MUNICIPALITIES SAVE UP TO 38% IN STREET CONSTRUCTION

WITH THE **SEAMAN MIXER**

The SEAMAN TRAV-L-PLANT — a self-propelled SEAMAN MIXER equipped with spray bar, pump, volumetric meter (optional) and complete tachometer assemblies.

Bituminous, soil-cement or gravel stabilized streets and parkways are lower in cost and higher in load bearing value when the mixing is done with the SEAMAN MIXER.

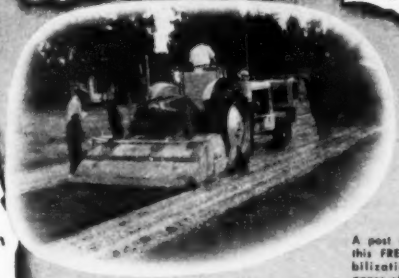
Here are brief performance stories in a few of over 100 cities owning one or more SEAMAN MIXERS.

Birmingham, Mich. reports a saving of $7,071.64 in labor in the first year of street construction with the SEAMAN MIXER.

City of Modesto, Cal. cut costs of street construction 38% by using a sand-cement base course stabilized with the SEAMAN MIXER.

Jacksonville, Fla. 42 miles of bituminous streets were constructed in 35 working days. All mixing was handled by the SEAMAN MIXER.

St. Paul, Minn., owner of two SEAMAN MIXERS, found that the machines permitted uninterrupted street construction, even during heavy rains.



The SEAMAN TRAV-L-PLANT mixing for an asphalt pavement in Jacksonville, Fla. Note that asphalt is pumped from transport truck and applied by spray bar on the SEAMAN.

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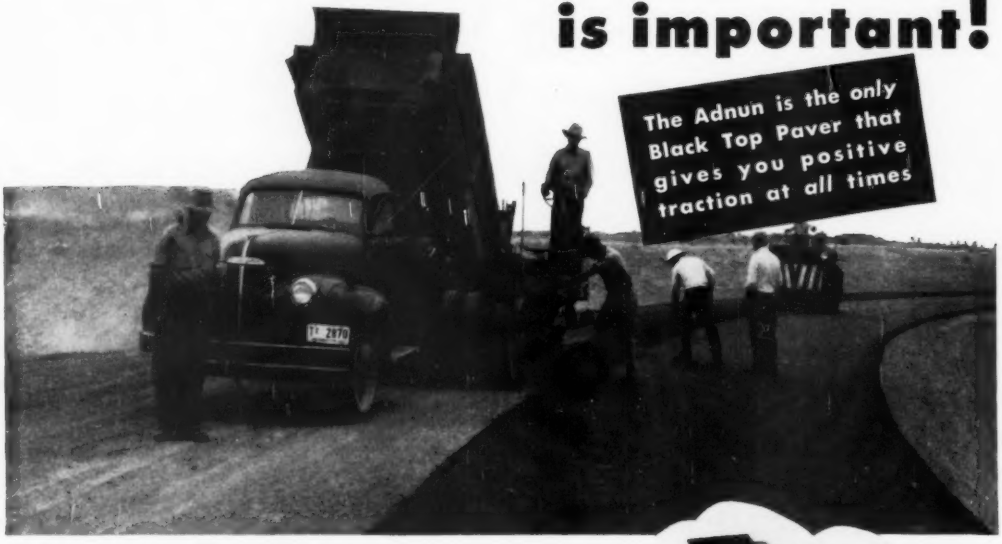

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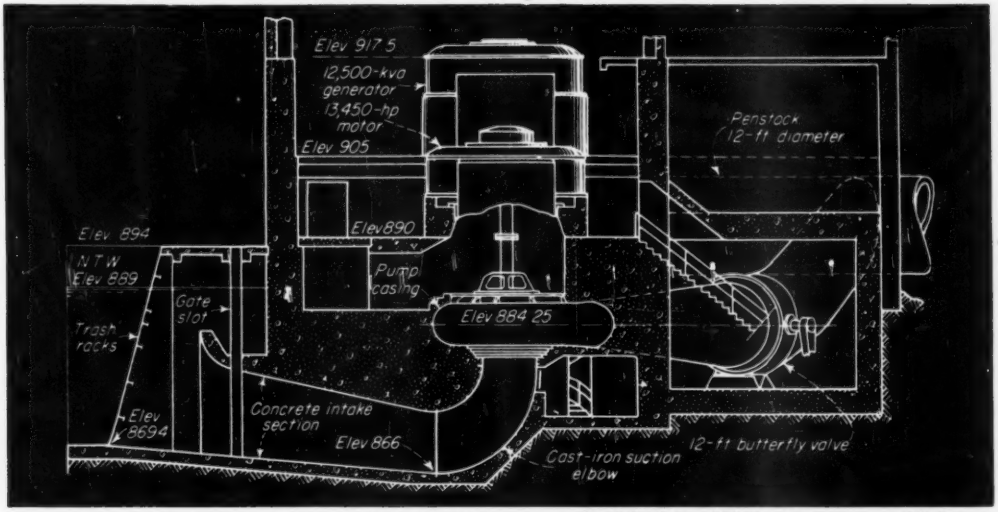
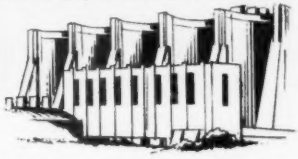


Specially-designed Worthington pump operated by Lower Colorado River Authority of Texas, at Buchanan Dam.

Big Pump Banks Hydro Energy

at 360,000 gpm—and low cost!



It's one of the largest in the world—the Worthington pump used for water storage at Buchanan Dam on the Colorado River in Texas.

There are three 12,500 kva generators at Buchanan Dam. The pump is used in connection with the third one. It uses low-cost off-peak energy to store water which can be used at times of peak load.

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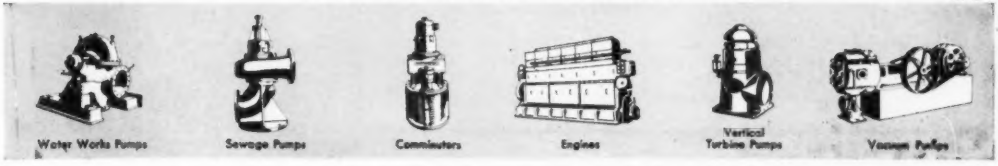

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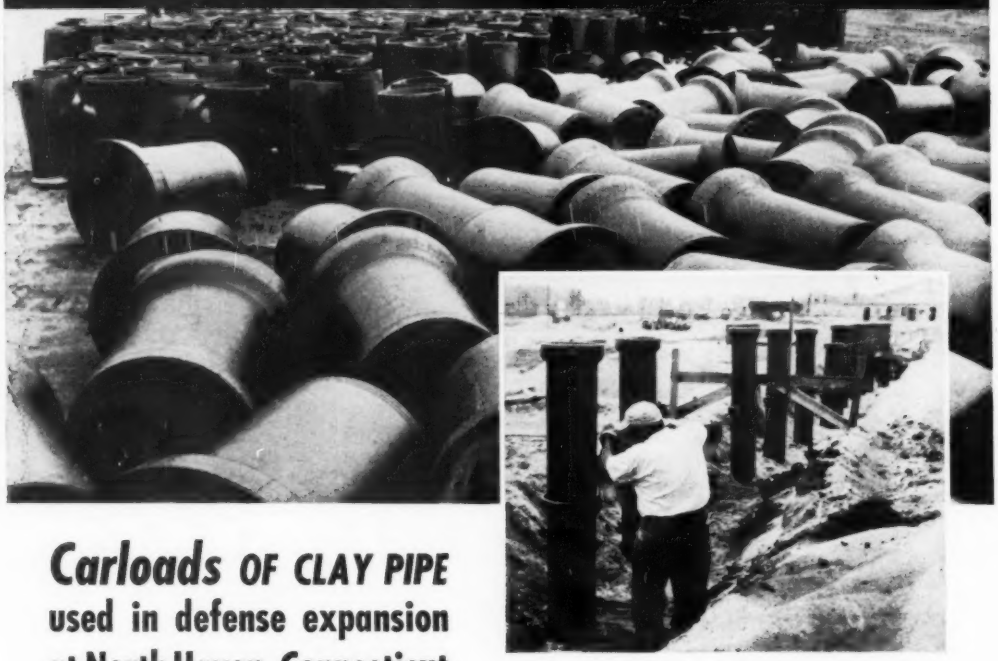

Carloads OF CLAY PIPE used in defense expansion at North Haven, Connecticut

Wherever the nation's defense program calls for expansion, Clay Pipe is in demand. Its protection is inherent in the pipe — can't chip off, squash out, or wear away, because Clay is *completely* safe — inside and outside, top and bottom, through and through. Without it, essential construction would be slowed to a standstill, and our cities would be ravaged by sickness. It's the *only* chemically inert pipe unaffected by sewer gases — the only proved-by-performance pipe that *can't wear out.* Be sure to specify it on all your jobs.

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PUBLIC WORKS Magazine

JANUARY 1952 ISSUE

VOLUME 83 • NUMBER 1

• SPECIAL EQUIPMENT FOR STATE HIGHWAY MAINTENANCE

HIGHER costs of labor and maintenance materials, with little or no increase in maintenance funds, have caused us to make greater use of equipment than ever before in order to perform the same amount of work with the same personnel. Some of the pieces of special equipment which have been used during the last few years by our Maintenance forces are described herewith.

ROUGHENING SLIPPERY PAVEMENTS—Several mechanical operations are performed in an effort to reduce the slipperiness of surfaces due to a flushed seal coat. During the fall days when a week or more of hot weather tends to soften and heal rich surfaces, preliminary roughening is accomplished by discing. Discing equipment consists of a multiple axle gang disc towed by a tractor or a heavy truck, or by a single-axle disc attachment to a motor grader. This discing is a fairly fast operation.

After the weather cools to a point where a rich surface will not heal, more positive scoring is undertaken with a pavement heater and scratch drag. The pavement is heated by means of flame generating equipment designed primarily to kill roadside weed growth. The flame is directed into a hood resting on the pavement and towed at slow speed behind the flame generating equipment. A metal drag consisting of several rows of 80-penny spikes is dragged behind the hood and serves to roughen the glazed surface. Generally, the rough condition produced remains until the following summer. This "scratch treatment" costs from $300 to $500 per mile of two-lane pavement.

G. F. HELLESOE,
Maintenance Engineer,
California Division of Highways

ROADSIDE BURNER—The State Division of Highways controls roadside growth on their right of way for the prevention of fires on adjoining agricultural and pasture lands. No work is done along sections of highway where adjacent land is cultivated, irrigated, or in orchards. Spraying and burning provides the maximum protection when placed from the toe of cut slopes up on the slope and from the top edge of fill slopes out and down.

• *ROUGHENING slippery pavements involves use of a heater in cool weather and a scratch drag.*

The machine used consists essentially of a blower powered by a small air-cooled engine, and a movable extended tube to which an oil burner head is attached. This machine is mounted on a four-wheel trailer which carries a 200-gallon tank for fuel oil. An intense flame is directed over a strip of grass and weeds as the machine is pulled along the roadside.

PATCHEATER—This piece of equipment is used in heating stockpiled material for making bituminous pavement patches in the winter. This method insures a much better and longer lasting patch than when cold material is used. A single unit will heat to proper applying temperature 7 to 8 cu. yds. of solidified material, per day, using about 50 lbs. of Propane or Rock gas.

HEAVY DUTY BRUSH CUTTER —This cutter is mounted on a special truck assembly. The machine has an industrial motor mounted on a revolving and extending carriage on the forward end of the vehicle. A heavy duty sickle bar is mounted on the end of an extensible boom attached to the carriage and is controlled by six hydraulic levers. The truck is driven by a separate engine through a conventional gearshift.

The machine will cut a six-foot swath through brush up to three inches in diameter at a speed of one-half to one mile per hour, depending upon the diameter and amount of vegetation to be cut. The flexibility of the machine is such that the operator is able to cut on any cut or fill slope as well as overhead. Extension of the carriage and boom will permit cutting brush as far as 17 feet from the machine. The cost of cutting per roadside mile is about $182 by machine as compared with $400 per roadside mile when cutting is done by hand.

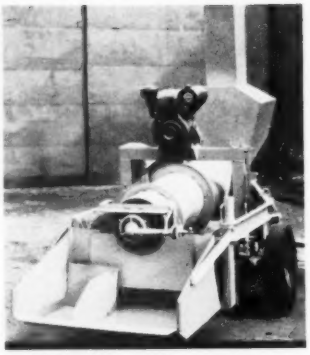
BRUSH DISPOSAL EQUIPMENT—This brush chopper supplements the heavy-duty brush cutter mentioned above. It consists of a special planer head revolving at 4000 rpm. and is powered with a 50 hp. gasoline motor. The speed at which the planer head revolves is sufficient to make it self-feeding and at the same time discharge the chips and shavings for a distance of from 20 to 30 ft. The machine is capable of disposing of brush and trees up to six inches in diameter as fast as two men can throw the material into the hopper. The chopper is mounted on a two-wheel trailer pulled by a pick-up truck which travels at variable speed, depending upon the amount of brush to be disposed of.

This chopper has decreased the cost of brush removal over the previous method of loading on trucks and hauling to a disposal site. We estimate the same amount of brush can be disposed of in one day with the same crew that previously required four days.

MACHINE FOR REMOVING OLD TRAFFIC STRIPES AND PAVEMENT MARKINGS — This machine, originally used for joint and crack cleaning of concrete pavements, is now being used for removing old traffic stripe and pavement markings. The machine has a semi self-propelling action and is equipped with a 13.3 hp. motor. The cutter wheels are either 2 ins. or 4 ins. in diameter and revolve at approximately 1500 rpm. It has been found that one set of cutters will clean approximately 1300 sq. ft. of markings in about 3½ hours at a cost of from 8¢ to 10¢ per sq. ft., whereas the cost of doing this work by the previous method of sandblasting was from 12¢ to 15¢ per sq. ft.

TANK TRUCK FOR ROADSIDE SPRAYING—For fire control work along our highways, a strip of clean ground is created 4 to 6 feet in width immediately adjacent to the improved shoulder, over which fire may not pass from the traveled way into adjoining property. This is accomplished by spraying the roadside with a soil sterilant, using a 1000 or 2000-gallon tank truck equipped with an agitator for proper mixing.

ASPHALT SUBSEALING TANK UNIT — Our Headquarters Shop has designed and built two efficient subsealing units. They are truck-mounted, fully insulated 2000-gallon tanks fitted with heating and pumping units. Heat is furnished by three pressure-type burners which use about six gallons of diesel fuel per hour. The net capacity of 1650 gallons of 10-25 penetration asphalt can be raised in temperature from 60° F. to 450° F. in about 2.5 hours. A 250-gal. per minute high pressure pump at a working pressure of 50 to 60 lbs. is used to pump the



● ***HEATED material makes better patches — The Patcheater.***

● ***REMOVAL of weeds from roadsides prevents fires. A blower powered by a small air-cooled engine is used in California.***

heated asphalt through two hoses, permitting the sealing of two holes at the same time. Nozzles are equipped with a control valve to permit circulating the asphalt when not actually sealing, and with a disc head on which a workman stands to force the tapered nozzle tightly into the hole drilled through the pavement. These subsealing units have proved to be very efficient pieces of equipment.

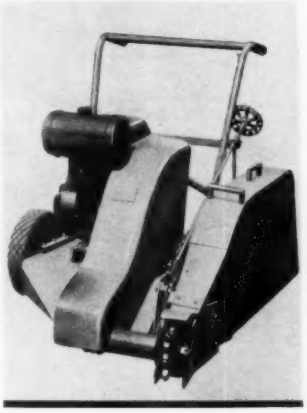
AIRLIFT DRILL RIG—Drilling holes through concrete pavement in connection with asphalt subsealing work was formerly done with two jackhammers run by a single compressor. During the last two years, an airlift single drill with an 8-foot swinging boom attached behind a truck-mounted compressor has been developed. A single operator is now able to drill more holes per day with this rig than was formerly done by two men using the jackhammer method.

● ***VACUUM litter collector picks up trash, paper, bottles, etc., from roadside, pulverizes and puts them in a hopper.***

LITTER COLLECTING VACUUM UNIT FOR ROADSIDE CLEANUP—This machine is designed to pick up paper, bottles, cans, and roadside trash by suction, pulverizing same and depositing the material through a 14-in. discharge line into a self-contained $1\frac{1}{2}$-c.y. covered hopper. Material so collected is then hauled away and dumped. The machine is powered by an industrial motor driving a 22-in. suction fan which also pulverizes the material.

We are now working on a design which will pick up the bottles and cans, without taking them through the fan, while the paper and trash will pass through the fan into the large trash container. This unit has not been used long enough to determine accurate costs but preliminary figures show a considerable savings will be effected by the use of this unit as compared with the old roadside cleanup by hand.

JOINT CLEANING MACHINE—Considerable experimenting has been done to develop a suitable machine for cleaning out expansion and dummy joints in concrete pavement preparatory to sealing. Our Headquarters Shop helped to develop a rotary joint cleaner weighing about 250 lbs., which has proved fairly satisfactory and has been used by contractors in this type of work. It is powered by a 3 hp. air-cooled motor which drives a 7-in. diameter steel disc with six $\frac{3}{4}$-in. carboloid insert cutting points at a speed of about 800 rpm. The machine is mounted on rubber tires and is easy to push. Old material cut out of the joint is picked up in a catcher attached to the machine, which may be easily emptied.



● ***ROTARY pavement joint remover speeds joint cleaning.***

• • •

Two-Way Radio Expedites Highway Work

Recently compiled Federal Communications figures show that 62 highway departments of state and local governments have received, or are in the process of securing, permits to use radio frequencies for communication between headquarters and equipment on the job. Six other departments are reportedly preparing to apply for permits.

Among benefits resulting from use of the two-way communication system are: (1) reduced losses in operating time resulting from equipment breakdown; (2) more effectively utilized equipment and more "teamwork" between various jurisdictions, such as road districts within the county; (3) more effective parts inventory control and transfer of parts between district; (4) prompt emergency service to any section of road (men and machines can be transferred from one job to another without returning to headquarters for instruction); (5) saving of lives in an emergency, such as a snowslide (workers can immediately radio for aid); and (6) reporting of snow and ice conditions promptly to the general public.—Police Chief News and Highway Research Abstracts.

• • •

Airport Weed Control Pays

The weed control program, which was started in 1950 at the Lewiston-Nez Perce (Idaho) airport, with the spraying of the entire airport area with 2,4-D was quite effective. The weed intensity was reduced to the point that profitable mowing of the airport was possible this past summer. Arrangements were made with a local farmer to mow the area for the hay and $100.00, a reduction of $163.52 over the cost of spraying the field during the previous season.

● ***SPREADING** sawdust by dump truck and Gledhill drag for curing soil-cement pavement*

● ***POISON** ivy control: Chemical spraying crew are using hand sprayers on this job.*

● ***POWER** saw is used to remove dead trees and cut firewood at State roadside parks. Use greatly reduces labor requirements.*

● ***HEAVY** equipment is used on Department force-account construction jobs on account of its efficiency and economy.*

EQUIPMENT

USE RESULTS IN GREATER SPEED, HIGHER EFFICIENCY AND LOWER COSTS

PENNSYLVANIA for many years has been convinced of the greater speed, higher efficiency and lowered costs that can be obtained through use of modern construction and maintenance equipment. From the days of the old Liberty and Quad trucks it has been qiuck to take advantage of the opportunities afforded by labor saving machinery of all types. As a consequence, the Pennsylvania Department of Highways is now operating 10,827 units of equipment having an original value of nearly $16,000,000.

In an average year the department adds about $2,000,000 worth of new equipment including both replacements and the new construction and maintenance equipment that is constantly being developed by the manufacturers. This equipment is housed in county maintenance buildings and in the garages of the eleven highway districts which extend throughout Pennsylvania to better meet the immediate demands of its 41,000-mile State Highway System.

To increase the efficiency of the snow fighting forces rental equipment is also used. It can muster 7,179 units of equipment, both Department owned and rented, for the annual struggle to keep Pennsylvania's highways in prime operating condition at all times regardless of weather.

These snow fighters are controlled by a radio telephone network which through 350 mobile and 67 fixed stations enables the Department to secure greatest possible speed and efficiency. Plows are shifted quickly to critical areas as occasion demands, without loss of time.

Both department owned and rental equipment is given skilled maintenance and is kept in first class condition so as to be prepared to meet unpredictable snow and ice conditions that suddenly descend upon Pennsylvania's mountains with little warning.

● ***FOUR-SPEED loader cleaning berm and loading into truck***

Snow removal is a costly operation. Last year's expenditures soared to more than $9,000,000. But the highways were open at all times. Motorists and cargoes moved. This is particularly important during the defense effort which throws an added burden of traffic on the highways.

The Labor Problem

The Pennsylvania Department of Highways has reached the inevitable conclusion that machines must be used in greater degree if highway efficiency is to be maintained. In the first place there would not be sufficient labor available to perform the work of the Department unless such modern machine methods were used. Then there is the urgent pressure of time. Traffic demands are so exacting that all work must be accomplished with minimum delay. Years would be required to complete the simple resurfacing jobs that confront us every day without the dozers, spreaders, rollers, graders and other machinery that speed up the work and reduce costs. Excavation is one of the potentially highly expensive jobs that constantly confront us. There are ample cost data to support the use of earth excavators which move mountains at less cost and in far less time than the old horse drawn dump carts moved hills.

The Department is proud of its record of less than one maintenance man for each three miles of its system. Only through use of ample machinery can this result be secured. We are also exceptionally proud of our men. They are loyal and steadfast workers, who constantly think of their jobs and frequently propose ingenious methods of performing their work. Few of our garages lack some type of a labor saver that the mechanics have built. Out on maintenance work new methods are constantly being perfected.

Novel and Improvised Uses

But it is in the novel use of equipment for other than its intended purpose or in the use of improvised equipment that the maintenance forces excel.

As we all know, the preparation of slopes for seeding is a laborious operation. But the maintenance men use a dozer at the top of the cut, a truck at the bottom with a cable between the two, to drag the slopes to an even surface for seeding. A reverse run and the seed is covered and ready for growth.

They have drawn on farm machinery for special jobs. Commercial lime spreaders have been adapted to soil stabilization use and as stone spreaders.

The spring tooth harrow and the old sheepsfoot roller are other farm machinery units that have been adapted to highway construction. Potato sprayers have been pressed into service for light applications of bituminous materials. Small con-

By E. L. SCHMIDT

Deputy Secretary of Highways
And
Chief Engineer
Pennsylvania Dept. of Highways

crete mixers double as mixers for patching material.

One inventive mechanic has perfected a stone drier made from a piece of culvert pipe. Plates are welded on the inside to toss the stone around. The pipe is mounted on a slope, a small engine and roller mechanism attached, the heating torch brought into action and dry stone pours forth for the road builders.

Paint mixers have been made. Usually these consist of a ferris wheel arrangement with cross bars to which the paint cans are fastened for a whirl around that thoroughly mixes the paint.

● ***LEDGE removal to widen road.***

Front End Loaders Are Versatile

Front end loaders appear to be developing into one of the most versatile machines in the Department. In addition to their normal use during the summer they are brought into action during the winter on abrasives and snow. This equipment is also used on earth grading jobs to slope banks, excavate for drainage channels and also to move fill on short hauls. It has also been used to place heavy drainage pipe in open ditches, raise structural steel on bridge projects as well as place steel floors on bridges. These loaders, it has been discovered, also make an excellent apparatus for removal of guard rail posts.

Small tractor mowers do not find a rest period at the close of summer. They are used to drag earth roads and shoulders, as front end loaders and with installation of a short low blade are used to push high shoulders or snow beyond the guard fence. The extension arms permit approximately a 5-foot travel of the blade beyond the guard fence proper. With blade attachment the small mower makes an excellent snow plow for walks around the buildings, at gasoline pumps and other locations inaccessible to the heavier plow equipment. When used to its full extent this machine reduces manpower needs considerably, the maintenance forces have learned.

Breaker and Tamper Speed Work

The self-propelled mechanical pavement breaker with an attachment is used to tamp pipe trenches. On concrete patching work it has eliminated the need of slow and costly hand methods with pneumatic pavement breakers and air compressors.

Motor graders, aside from their conventional uses have been adapted to snow removal by utilization of both the cutting blade and a snow plow attached to the front end. In widening, narrow cutting edges have been attached for the excavation of earth and rock fill. The material is then picked up by an automotive loader.

Power shovels also are used on a wide variety of jobs. On installation of heavy pipe culverts and arches the ditch can be dug, the pipes placed and back fill completed with minimum detour or traffic restrictions. They also load and unload heavy structural steel as well as install it. Power shovels have been used to good advantage in removing wooden decks from bridges thereby speeding up the work and bringing an earlier end to traffic delays. Pans and scrapers have been used to slope banks and also for fine grading prior to the placing of pavements. A crawler tread has been found excellent for dragging out slopes with a minimum of labor.

The improvised use of standard equipment is almost endless.

Maintenance forces in their constant search for new and better and less laborious methods of accomplishing the desired results usually emerge with a practical solution. The net result of this skill has been that maintenance costs now require but 17.4 cents of each dollar of Pennsylvania Department of Highways' income compared with an average of 31.5 cents during the sixteen years preceding 1947. Despite heavy increases in costs of labor, material and equipment, mechanization and improved operation and management have kept maintenance costs down. In 1930-31, when labor cost 40 cents an hour, maintenance costs amounted to $671.00 per mile. In 1938-39, with labor costs at 45 cents an hour, the cost per mile for maintenance was $579.00. By 1949-50, labor costs had risen to 95 cents an hour and average maintenance costs per mile were $635.00. With a wage rate of $1.04 per hour in 1950-51, maintenance costs aggregated $737.00 per mile.

Improved materials and methods have increased the resurfacing cycle on bituminous roads subject to surface treatment. In 1938-39, the 20,000 miles of such roads were on a 3-year cycle of resurfacing. In 1950-51, the 26,000 miles of roads then in service, were on a 6-year cycle, due to better materials and methods, with resultant decrease in cost.

Maintenance ratings given Pennsylvania by the Bureau of Public Roads are among the highest in the nation.

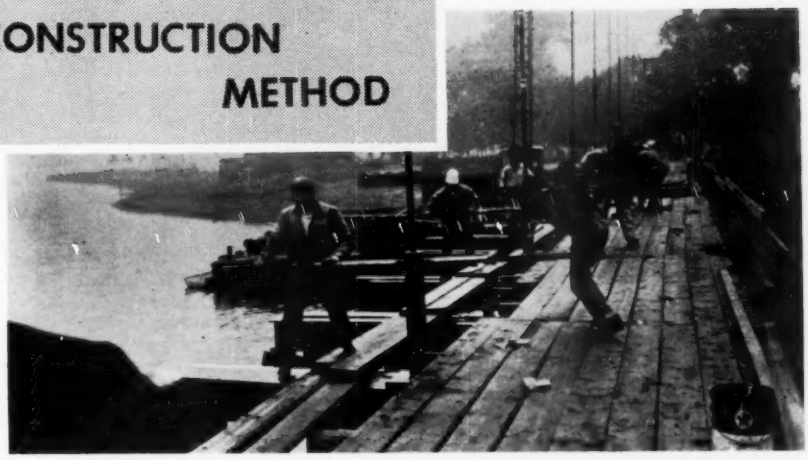
● ● ●

Fire Protection at Chicago Midway Airport

With three independently operated pumping units on the job, American Airlines headquarters at the Chicago Midway Airport has an ample water supply available for fire protection under almost any circumstances. Two of the pumps are electrically driven and are set to start pumping when water pressure drops to 90 and 85 pounds respectively. The third pump is a Dayton - Dowd Centrifugal unit driven by a General Motors 6-cylinder Diesel engine.

This unit is regarded as an emergency unit as it goes into action only in the event electricity fails to reach the No. 1 and No. 2 pump motors and/or the water pressure drops to 80 pounds. When this happens, the engine starts automatically and can deliver 2,000 gallons per minute at 100 pounds pressure. This amount is sufficient to deliver water from Chicago's water mains to a sprinkler system protecting two airplane hangars and office space with a total of 150,000 sq. ft. The Diesel automatically and unattended starts up three times a week for 20 minute test periods thus proving its constant availability for emergency standby service.

UNUSUAL CONSTRUCTION METHOD



● *CREWS man oversize wrenches to lower 300-ft. section of 64-inch pipe.*

FOR BIG BOSTON PIPE LINE

LAYING a concrete encased pipe line beneath the Charles River, Boston, Mass., presented a number of problems. The pipe, 64 ins. in interior diameter and lined inside with 2 ins. of gunite, was encased in a 10-inch ring of reinforced concrete. The river crossing line is 544 ft. long, with 50-ft. long sections rising at an angle of about 45° at either end to bring the line flush with the trench ashore.

The many low-lying bridges over the Charles made it impossible to bring floating derricks up for placing the line and the process of laying the pipe piece by piece and joining the sections by divers under water was deemed to be too slow and costly. A new method was therefore devised by the contractors, Merritt-Chapman & Scott.

This is the way it was done: Starting on the Cambridge side, 27 pairs of steel piles were driven to the halfway mark of the river along each side of a deep trench dredged across the bottom. While the Charles is only approximately 8 feet deep at that point, the trench was dredged to a depth of 30 feet below the surface.

The piles, set approximately 12 feet apart in the river and 8 feet apart near the bank, were driven so that their tops were about 17 feet above water. A working platform was then built between the piles some 3 feet over the water, running from the shore to mid-river. Two steel beams were then strung between the tops of each of the 27 sets of piles, forming supports for an upper working platform.

Sections of the steel pipe, each 34 feet long, were then skidded out on the lower platform and welded together atop blocking which raised the pipe line 10 inches above the platform. Both ends of the 300-ft. long section were sealed with watertight bulkheads to prevent flooding when it was lowered.

Next, heavy wire rope "carrying slings" were placed around the pipe where it passed between each of the 27 pile bents. The carrying slings were in turn, shackled to heavy, threaded steel rods screwed down through bearing nuts set atop openings burned through the overhead steel beams.

Each of these 27 threaded rods was $2\frac{1}{2}$ inches thick. The rods were fabricated in two lengths, 12 to 14 feet, and these were installed alternately along the pipeline. The 6-inch diameter bearing nuts through which they were threaded were mounted on roller bearings and were fitted with specially designed wing-handled wrenches so that each could be turned by two men working on the top platform above the pipe. That meant that the entire 300-foot length of pipeline could be lowered evenly and smoothly in its carrying slings by simultaneously turning the overhead wrenches.

Concreting the Pipe

Once work had progressed this far, Merritt-Chapman & Scott was ready for concreting. As a first step, octagonal-shaped forms and a webbing of reinforcing steel were built up around the pipe for construction of its 10-inch outer casing of concrete.

Not all the concrete was placed in one operation, however. That would have made the pipe too heavy to handle while it was being lowered the few feet to the surface of the river. To minimize the strain on the carrying slings, only the lower half of the pipeline's casing was poured in the first operation a total of approximately 130 cubic yards weighing approximately 260 tons.

After this concrete had set, Merritt-Chapman & Scott crews used their over-size wrenches to raise the partially concreted pipe several inches until it hung clear of the lower working platform. The platform was then dismantled, along with the lower half of the concrete forms. With two men working each

of the 27 wrenches, the entire 300-ft. section was then carefully and evenly lowered until its concrete-encased lower half rested in the water.

With the buoyancy of the water supporting approximately one-third of the pipe's weight—then estimated at approximately 350 tons—the contractor proceeded to pour another 120 cubic yards of concrete for the top half of its casing. Once this had set and the forms had been stripped, all was ready for today's final operation.

Manning their wrenches atop the upper working platform 17 feet above the Charles, workmen lowered the pipeline in unison. The rods were threaded 4½ per inch, which meant that each five complete turns of the 27 wrenches sent the 300-foot section approximately an inch deeper into the river.

Once the pipe was completely submerged, a halt was called in the lowering operations. By this time the tops of the 13 alternately spaced 12-foot-long rods had passed through their bearing nuts and were standing clear approximately a foot below the supporting overhead cross beams. The entire weight of the pipe, more than halved by the buoyancy of the water, was now carried by the alternately spaced 14-foot-long rods. At this point, the tops of the latter rods were almost flush with their bearing nuts. As planned in advance, a system of extension rods had to be installed before the pipeline could be lowered any farther.

As a first step, a set of 24-foot-long rods were sent down through the new empty bearing nuts above the 12-foot rods, and were coupled to the latter. After the couplings were completed, lowering operations were continued as before. As it went down, the 14-foot-long rods passed clear of the bearing nuts and were removed, leaving the pipeline suspended from the 13 to which the extensions had been added.

● ***RISER section of 64-inch pipe line being lowered to trench in bottom of river.***

Once the pipeline was on the bottom of its trench 30 feet below the surface, divers were sent down for an underwater examination to see that it was evenly seated. The divers then unshackled the remaining rods from their carrying slings, and burned off the portions of the carrying slings which were not embedded in the concrete.

The next step on the Cambridge side of the river will be the construction of a cofferdam around the shore side of the now submerged pipeline. On its completion, the area inside the cofferdam will be pumped out, permitting work "in the dry" when adding the last 34-foot-long riser section which will bring the pipeline up to the level of the 8-foot trench in which it will be buried ashore.

With the Cambridge side of the line in place, the same technique will be repeated to lay the second half on the Boston side of the river near Braves' Field. In the final operations, divers will join the two halves of the pipeline at mid-river, a concrete casing will be poured underwater to seal the joint, and the trench will be backfilled. The watertight bulkheads at the mid-river and shoreside ends of each of the two sections will be burned out later from inside the pipe.

Charles Richardson of Merritt-Chapman & Scott's Boston Office is project manager on the job and Jesse Comer is superintendent, both working under Alfred M. Heaton, resident vice president in charge of the company's New England operations, and Ralph E. DeSimone, executive vice president and general manager. Stewart Associates of Cambridge, Mass., are consulting engineers on the project, with A. L. Guild serving as resident. Harold J. Toole, director and chief engineer of the Water Division of the Metropolitan District Commission, is in over-all charge of the project, with Charles O. Clark, associate engineer, representing him.

Water Pump Places Grout To Plug Sewer Leak

A SMALL leak developed at a drop manhole in the Metropolitan Sewerage Commission intercepting sewer along the Menominee River Drive, Wauwatosa, Wisc. This sewer is of integral concrete construction and, except for this one leak, has no problems. The leak was plugged with a specially mixed grout forced into place by a small, hand-operated, reciprocating water pump.

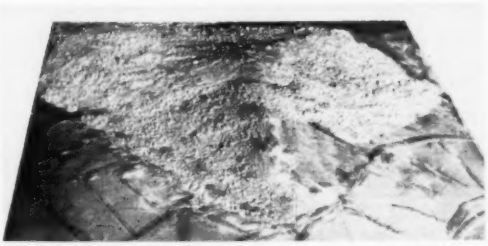
Three bleeder holes were drilled through the wall of the sewer to relieve the water pressure. After the water had drained out, the original leak was patched with cement grout. Three nipples, with cock valves, were then placed in the three bleeder holes. Above, near the manhole, the small pump was set up with the suction connected to a mixing box and the discharge connected to one of the bleeder holes by a rubber hose. A screen across one end of the mixing box prevented large lumps from plugging the pump or hose.

A mixture of portland cement, bran and water was then pumped into the bleeder hole until refusal; then another bleeder hole, and finally the third one was filled with the bran-cement grout. The pump and hose were washed out with water, the valves being removed so that a thorough job could be done. After the grout had set, the bleeders were removed and the holes smoothed with ordinary grout.

L. T. BRUHNKE

The work was done by Walter Hoenecke, master mechanic of the Otto Seefeld Co., contractor. The pump had a 1¼-inch inlet and 1-inch outlet, with rubber ball valves. These do not last long when pumping grout, but replacement is simple. As a matter of fact, almost any kind of a pump can be used for this work; and when a large amount of grout is to be pumped, a centrifugal pump is likely to be used.

According to Mr. Hoenecke, a bran and water mix will not pump, but when cement is added, it pumps easily. Sawdust may be used instead of the bran, and is preferred in some places; and it is cheaper. This may be a factor where much grout is required.



● ***FINISHED** portion of area shown at right. Screen, cover material and vegetation added.*

● ***BLOCKS** form intermediate contours and simplify construction. Finished model at left.*

How to Make
A Low-Cost Terrain Model

IT is easy to make a terrain model to proper scale, both vertical and horizontal and such a model will be found valuable for visualizing problems in construction, showing what the finished job will look like, and for public relations.

First, the overall size of the model and the vertical and horizontal scale must be determined. The model should be so planned that it can be divided into sections for easy handling. The map to be used should show all necessary contours. It should be enlarged or "blown-up" to the actual size of the model to be made. The enlarged map is then pasted on base pieces which, preferably, are about 3 ft. square and mounted on 1-inch by 2-inch stock around the edges.

There are two ways of making the terrain model—the "one-hill" method and the "rolling terrain" method. A decision must be made as to which of these will be used.

The "One-Hill" Method

In this method, a band or jig saw is used to cut around each contour line; or a cut may be made at every other contour and small blocks used for the intermediate contours. The cut-out contour sections are then mounted, one above the other to show the terrain. The depth of each section must be correct and this is determined by the thickness of the sections on which the cut-outs are mounted. After the model has been built up by setting the cut-out sections one above the other, a wire screening is tacked over the whole, adjusted as necessary to simulate the terrain, and the screen covered with some plastic material. Coloration, trees and other surface details can be added later.

The "Rolling Terrain" Method

In this method, vertical cross-section pieces are cut along the critical lines, such as ridges and valleys, using the correct vertical and horizontal scale. These vertical pieces are then fastened to the base at the correct locations, and the wire screening is then tacked over these. The screen is then pulled out or pushed in to resemble the terrain according to the maps. This method requires more adjustment of the wire screening, but this is easy and the method gives very realistic results.

Next, no matter which method is used, a pasty mixture is spread over the screen. The author recommends a mixture of one part of stock glue and one part of water. This is melted together slowly and then an additional two parts of water are added. This is applied to the screen with a small trowel or a putty knife while it is still warm, so that a smooth and even coat can be applied. If the surface shown is a beach, the cover can be spread evenly and allowed to dry. If the area is cultivated land, a fork can be used to "plow" the fields before the cover has finally set. If the area is wooded, the plaster is spread on smooth and while it is still wet a ground or brush color is painted on. Damp globules of plaster can be used for trees. When dry, the top can be touched with a brush or wiped with a rag, using green paint to give the proper top color. Roads should be "bulldozed" out with a small stick while the covering is still wet, using a stick of the proper size. Buildings are easily made with balsa wood from a model airplane kit. With a little ingenuity, any other terrain feature can be reproduced realistically.

From an article by LTJG J. H. Benton, CEC, USN, in the *CEC Bulletin*.

● ***BACKGROUND** can be painted in to give effect of depth.*

Conserving Critical Materials

in CONSTRUCTION of

THE experience of World War II, and more recently of Korea, has shown that in times of emergency both the weight and volume of essential truck traffic increase rapidly. Approximately 75 per cent of the materials and supplies shipped to and from defense plants is carried by trucks. And, of course, military traffic is stepped up considerably. This increase in the volume of industrial and military traffic demands roads and streets capable of carrying vehicles of maximum legal axle loads rapidly, safely and efficiently without breakdown.

Thus concrete pavement may be considered vital to national preparedness. Of the materials normally used in its construction, the most critical is steel. Concurrent with an increase in the need for concrete pavement, there has been a decrease in the amount of steel which may be used for such construction.

The situation may be likened to that of the early '40's, save that today we have the experience of the recent past to aid in practicable solutions. Early in World War II, the Highway Research Board of the National Research Council requested a group of engineers to investigate designs of concrete pavement using a minimum amount of steel or none at all. From this investigation came the report "Design of Concrete Pavements Requiring a Minimum of Steel" published in 1942 as Wartime Road Problems Bulletin No. 3*. The recommendations contained in this report are as applicable today as when published nine years ago. Data obtained from road construction during and since World War II complement the value of this information.

How Steel Is Used

Before savings in steel can be effected, it is necessary to know in what ways it is used in concrete pavement, and its function in each instance.

The following are the ways in which it is employed:

1. As distributed reinforcement, in the form of mesh or bar mats.
2. For load transfer devices at transverse expansion or contraction joints.
3. For deformed metal plates for longitudinal hinged joints.
4. For tiebars across longitudinal joints.

It will be noticed that three of the four major uses of steel occur at transverse or longitudinal joints in the pavement. Any effort to save steel must, then, first involve attention to jointing practice and design. Actually this applies also to distributed reinforcement, for in order to save or omit distributed steel, the pavement must be designed in such a way that this type of reinforcement is not required. Such design is to a large degree concerned with the location, spacing and construction of joints.

Saving Distributed Steel

The purpose of distributed steel is not apt to increase the load-carrying capacity of the concrete nor to prevent cracking, but to hold cracks together when and if they form. For this reason, distributed steel can be omitted without a sacrifice of load-carrying capacity or serviceability of the concrete if the pavement is jointed so as to control intermediate cracking.

Experience has shown that a satisfactory control of cracking can be effected by placing expansion joints at long intervals with intermediate dummy-groove type contraction joints to divide the pavement into slab lengths of from 15 to 25 feet. The types of aggregate used for the concrete have a major influence on the spacing of contraction joints, as the recommendations in Table I show.

Where streets intersect, ¾-in. expansion joints are recommended at each side of the intersection. Experience suggests use of wood filler in these expansion joints, either in board or block form. Wood filler assures less closure of the joint; and this, in plain concrete pavement, serves to reduce the maximum width of openings at contraction joints, permitting full development of aggregate interlock.

Dummy-groove type contraction joints may be formed in the spaces between expansion joints by providing in the top of the slabs grooves with depths equal to one fourth the thickness of the pavement. These grooves, ⅜ in. wide at the top, are sealed with bitumen or other plastic filler to prevent infiltration of foreign material.

Table 1—Recommended Spacing of Contraction Joints.

Type of Coarse Aggregate	Recommended Spacing of Contraction Joints
Crushed granite	25 ft.
Crushed limestone	20 ft.
Crushed flinty limestone	20 ft.
Gravel, calcareous	20 ft.
Gravel, siliceous	15 ft.
Gravel less than ¾" in size	15 ft.
Slag	15 ft.

Load Transfer Devices

Dowels and other load-transfer devices have several purposes, chief among these the reduction of stress in the pavement at transverse joints. Stresses from wheel loads passing over the interior portions of a concrete pavement slab are distributed over a large area of the slab in all directions. But at transverse expansion joints and at transverse contraction joints if there is an appreciable gap in aggregate interlock, these loads are spread over a smaller area, and the stresses—especially bending stresses—are proportionately more intense. Dowels act to transfer part of the wheel loads from the end of one slab, across the transverse joint to the adjacent slab, increasing the area over which the load is distributed and reducing stresses in both slabs. They are designed to permit the slabs to move

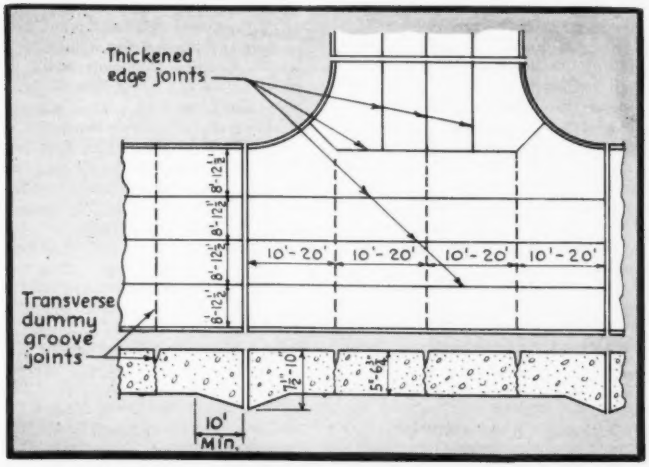
*Available from Highway Research Board, 2101 Constitution Ave., Washington, D. C.

CONCRETE STREET PAVEMENT

longitudinally, while guarding against vertical faulting.

By omitting expansion joints or by using them at long intervals, as previously discussed, the amount of steel required for dowels or load transfer devices at these points is reduced to the minimum. Such design is economical. But to conserve steel, the dowels may be omitted entirely at expansion joints when the pavement slab is thickened to make the slab ends structurally adequate without load-transfer devices. While the cost is greater, savings in steel may justify such design.

earlier and used in pavement without expansion joints or with wood-filled expansion joints at long spacings. Under these conditions, the crack below the bitumen-filled surface groove at contraction joints is very small. When the slab is in compression, the faces of the concrete are held tightly together. When the pavement is in contraction, the joint opens such a very slight amount that the irregular, interlocking faces of the concrete still give adequate load transference. Pavements constructed with a jointing plan of this design have excellent service records.



● ***RECOMMENDED jointing arrangement at street intersection, without steel. Sectional view shows thickened ends.***

When this design is employed for thickened-edge pavements, the slab ends at joints should be the same thickness as the edges. In uniform thickness designs, the slab ends should be one inch thicker than the depth of the normal cross section. The transition from normal cross section to thickened end should be gradual, and the taper accomplished over a distance not less than 10 ft.

Load transfer devices are not needed at transverse contraction joints if these are of the dummy-groove type, spaced as recommended

Deformed Metal Plates and Tiebars

A deformed metal plate is sometimes used in the forming of a hinged-type tongue and groove longitudinal joint. Its function is the same as that of a dummy-groove type of longitudinal joint, i.e., to help insure load transfer across the center joint between slabs. In the dummy-groove type of longitudinal hinged joint, aggregate interlock in the fracture below the top groove provides load transference. In the deformed metal plate type of center joint, the "key" provides load transference. The dummy-groove type of longitudinal hinged joint has a good service record. Whether the pavement is of uniform thickness design or of thickened edge design, the dummy-groove type of longitudinal joint may be used to eliminate deformed metal plates, saving the steel required for the plates.

Tiebar Functions

The function of tiebars is to hold together the faces of adjacent slabs at longitudinal hinged joints, so that either aggregate interlock in the case of dummy-groove type joints, or the key in the case of deformed metal plate type joints, will provide adequate load transference. Tiebars are usually deformed steel, unlike dowels which must be smooth metal. They differ in other ways from dowels. They are bonded to the concrete and act in tension only, whereas dowels are not bonded and function in bending and shear.

Under some conditions, tiebars may be eliminated or reduced in quantity. If a uniform thickness design is used, the free edges which may develop require no assistance from the adjacent slab. In thickened edge design, the pavement edges at longitudinal joints may be thickened as well as at outer edges. In either case, tiebars are not required structurally. And where the pavement is confined by curbs, sidewalks, structures or earth fill in such a way that the slabs cannot separate along the longitudinal joint, tiebars may be omitted. If separation is possible, a reduced number of tiebars may be used, about half the number required when used for structural purposes.

The illustration shows the jointing arrangement at a street intersection of a plain concrete street pavement using no steel, and a cross-sectional view showing thickened slab ends at expansion joints. An integral curb is recommended. Where an integral curb is not used with thin center section pavements, the outer edges of the pavement should be thickened along with, and in the same manner as longitudinal joints.

● *ARTIST'S sketch, showing layout of the Sabetha sewage treatment plant described here.*

SEWAGE TREATMENT P
KENNETH LARK

Industry and City Cooperate

DWIGHT METZLER
Chief Engineer, Division of Sanitation
Kansas State Board of Health

INDUSTRY and city officials are cooperating to solve a ten-year-old mutual problem of waste treatment at Sabetha, Kansas. The industry, a cooperative creamery, has agreed to pay the city $85,000 to help build a new waste treatment plant to be owned and operated by the city. The creamery and an adjacent milk products plant are located within the city. Both are connected to the city sewers which receive all the wastes except the condenser pan water, which is discharged into an open drainage ditch.

Sabetha is a city of 2,400 persons and is located in a typical farming section of northeastern Kansas. In the late 1930's the Nemaha County Cooperative Creamery was established in Sabetha. Because it was located in a favorable section of the state for dairy herds and was guided by a progressive manager, it expanded rapidly. With this expansion came overloading of the city's sewage treatment plant. Since Sabetha rests on a ridge near the head waters of two water sheds, there is no dilution water available and pollution complaints from landowners began to be directed to the State Board of Health.

A field survey, made by the Board's engineers in the late summer of 1947, included a very careful analysis of the creamery's intake and waste products which were discharged to the sewers. Making the study was more difficult than might have been anticipated because the plant had been added to several times and there were no plans showing the location of waste lines. Later these data were brought up-to-date by a consulting engineer who prepared a report for a new plant in 1949. Recommendations of the consulting engineer, concurred in by the State Board of Health, were that the milk wastes be given pre-treatment by the creamery and that they be discharged at a constant 24-hour rate into the municipal sewer system. This would have required some changes and additions to the existing plant which consisted of an Imhoff tank, trickling filters and a final settling tank.

The creamery did not agree to this arrangement and submitted a substitute proposal to reimburse the city for part of the treatment costs if a second plant were built on the opposite side of the city from the first and near the creamery. Dairy officials and milk inspectors having jurisdiction both insisted that a pre-treatment works for the wastes would cause odors that would affect the quality of the plants products and would likely cause it to be degraded. This prejudice against pre-treatment on the creamery's grounds caused the officials to offer the city a cash sum if it would receive and treat the wastes.

After consultation with the consulting engineer and the State Board of Health, the city accepted this proposal. Allowance was made in the design for a total flow of 142,500 gallons per day; of this amount 67,500 gallons were assumed as coming from the creamery and 75,000 gallons were domestic sewage. In terms of oxygen demand, an allowance was made for 765 pounds per day from the creamery, and 255 pounds from the domestic wastes. The plant was further designed on the assumption that the industry will discharge at a maximum rate not greater than 9,000 gallons per hour. This was specified in the permit which the Board of Health has issued to the city.

To assure a relatively fresh sewage, the treatment plant is located about 25 minutes flow time from the creamery. Sewage is preaerated for 30 minutes, then passed to a rectangular sedimentation basin. To keep construction costs to a minimum, the primary, secondary and final clarifiers are designed as rectangular units with common walls. Also, the aeration basin, control house, and wet wells are part of the single structure. Each clarifier is 36 feet long and has an average water depth of 7 feet. The primary clarifier is 12 feet wide and the intermediate and final clarifiers are each 10 feet wide. Overflow rates are 1,000, 600 and 600 gallons per square foot per day respectively.

Primary units are planned to operate at a constant rate of 432,000 gallons per day. This will give a re-

LANT, SABETHA, KANSAS
N & ASSOCIATES

● ***PLANT units, left to right: Digester; primary and secondary tanks; filters; and sludge beds.***

in SEWAGE TREATMENT

circulation ratio of about 2 to 1 at the design flow. The constant flow will be controlled by a float operated butterfly valve located in a uniquely designed set of control channels ahead of the pre-aeration basin.

Operational Flexibility

The plant will be very flexible from an operational standpoint. At least six operation plans can be followed. They are:

(1) A conventional two-stage filter plant with primary, intermediate and final settling.

(2) By means of baffles in the control channels, the primary settling basin can be bypassed with the flow going to the intermediate settling basin to the first-stage filter, to the final settling basin, and to the second-stage filter with the effluent going to the stream.

(3) By means of baffles in the control channels, the intermediate settling basin can be bypassed, with the flows as follows: pre-aeration, to the primary settling basin, to the first-stage filter, to the final-settling basin, to the second-stage filter with the effluent passed to the stream.

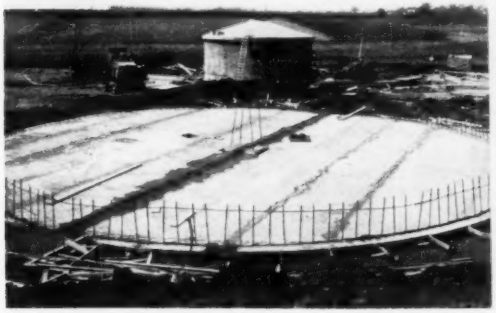
(4) By means of baffles in the control channels, the final settling basin can be bypassed.

(5) By means of baffles in the control channels, the filter effluent can be diverted either to the intermediate or final settling basins, or to the stream, thus allowing either filter to be bypassed.

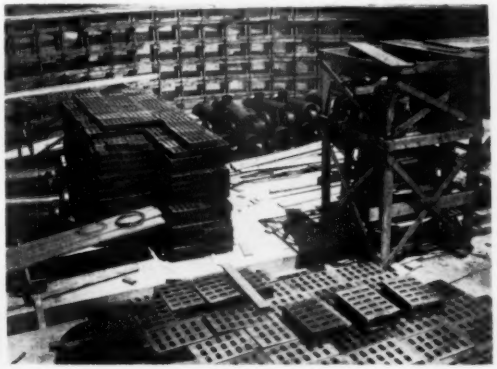
(6) It is possible to pump the effluent from any of the settling basins to either of the filters and it is possible to operate the filters in either series or in parallel, but with all three settling basins in operation, it will not be possible to alternate the filters in two-stage operations.

Both of the filters are of the same size. The first filter is designed for a loading of 1,580 pounds of BOD per acre foot not including the recirculated sewage, and the second stage filter is designed for a loading of 330 pounds per acre foot. This results in an overall design loading

(*Continued on page* 82)



● ***FLOOR of filter has been poured and reinforcing rods are in position for next step.***



● ***INTERIOR: Dickey underdrains in foreground; distributor support at right; forms in place.***

SOLVING PARKING PROBLEMS in

NEED for additional off-street parking facilities in the downtown part of the city were emphasized two years ago by the Minneapolis Chamber of Commerce. The Chamber's Street Traffic Committee, organized in 1946, had made a continuing study of the problem and concluded that the erection of a number of multi-story parking garages would save the Minneapolis loop section from the troubles of decentralization.

By July of last year, the Street Traffic Committee had persuaded downtown business interests in Minneapolis to underwrite the expense of erecting two off-street parking decks. As a result, a corporation, Downtown Auto Park, Inc., was formed, its officers and directors serving without salary.

The corporation functioned quickly. The officers and directors began raising equity capital, arranging long-term mortgage financing, and consulting with architects and engineers. Parking engineering assistance was furnished by National Garages, Inc. of Detroit. Within a few months, the group acquired two sites—one at Marquette and Fourth Street and the other at LaSalle Avenue and Ninth Street both in the central loop.

Two New Parking Ramps

Last month the first of the two parking structures was completed at Fourth and Marquette; and in October the LaSalle ramp opened. Total cost of the two ramps, not including land sites, was $1,413,000.

So in hardly more than a year's time two capacious buildings have become available to "shelve" the public's vehicles. The Marquette ramp accommodates 535 cars on its six levels; the LaSalle ramp provides space for 819 cars on eight levels. Parking rates are 25¢ for the first hour, 15¢ for each additional hour and a maximum charge of $1.50 for a 24-hour period. For regular parkers, stalls are rented at monthly rates ranging from $12 on the roof to $23 in the basement.

The two garages are operated under a management contract by National Minnesota Garages, Inc., an affiliate of National Garages, Inc., Detroit. Facilities offered at the ramps include attractive waiting rooms and complete auto servicing equipment, including lubrication and washing. Both ramps are designed to take cars off the street quickly and without congestion. The Marquette ramp has a receiving magazine that will hold 16 cars; the LaSalle ramp will handle 30 cars in its reception area.

Keynote of the entire operation is swift operation and courtesy. Attendants are alert, never fail to greet incoming parkers and to inquire if they wish their cars filled with gasoline, lubricated or washed. But it is when a patron returns for his car that the lightning-like service becomes evident. Even before the cashier takes any money, she hands the ticket to a waiting carhop who dashes to the "manlift," shoots up to the proper deck and delivers the car to the startled customer almost before he can say "I like parking in downtown Minneapolis."

Even during rush hours, cars from the top deck can be delivered outside the waiting room within the span of three minutes. More often, the waiting time is measured in seconds. And this is accomplished without any racing of engines or squealing of tires. In fact, it's almost impossible to make tires shriek in the ramp because driveways are surfaced with coarse, tire-gripping concrete and all sloped areas have serrated treads.

To find out how motorists are impressed with the service and facilities at the Marquette ramp, several patrons were interviewed while waiting for their cars to come down.

Customer Comments

Russell J. Nelson, Minneapolis: "My business brings me to this area quite frequently and I always had trouble finding a place to park. But that's all over with now. Finest service I've ever seen."

George Hefferman, Minneapolis: "This parking deck fills a long-felt need in downtown Minneapolis and is as fine as I've ever seen. We need more such structures in the city."

Mrs. C. B. Thompson, Anoka: "For many years we have been coming to Minneapolis to shop, but it was getting hard to find a place to park. This parking garage solves all that—and it's so handy to the big stores."

Mrs. C. E. Ennis, Minneapolis: "This is wonderful for shopping. I think the service is tops and the attendants are so courteous."

J. B. Small, Minneapolis: "This is my first time in—my wife has parked here several times and she urged me to come in." (At this point Small's car was delivered—hardly 15 seconds after he had turned in his ticket.) "And, the service here is good!"

Officers and directors of Downtown Auto Park are pleased with the speed with which the two ramps were completed—from the "scratch pad" stage to finished, attractive buildings in only a little more than a year's time. They are gratified that the costs of the two buildings —about $3.50 a square foot, or $1,000 per car stall—are commensurate with expected income from the properties. They are proud that private enterprise has successfully taken over a job which has been left to government to accomplish in many other cities.

Curbs and Shortages

The fact is, the group forged ahead with its plans in the face of many disheartening obstacles. For example, long before the property for the two sites had been acquired, the Korean fighting erupted and construction curbs and material shortages seemed likely. The officers of the corporation moved quickly—they realized that shrugging hopelessly wouldn't help. At once they bought all the necessary

MINNEAPOLIS

steel and concrete to complete the projects although the plans at that time were still incomplete.

Stockholders—practically all of them are loop business concerns which will benefit indirectly from the new parking facilities—are not investing primarily for return. But officers think it probable that, after the debt has been reduced through application of depreciation accruals and retained earnings, the common stock equity in the corporation may attain substantial value.

Parking Needs

How far will the two new ramps go toward solving Minneapolis' parking problems? Quite a way, according to figures available in the city Traffic Department.

The "convenience area" for parking in the loop shopping district is defined as extending a radius of about two blocks from Seventh Street and Nicollet Avenue. In this area, there already exist some 680 meter parking stalls at the curb. On the average, each of these stalls handles 20 cars daily from 8:00 A.M. until 6:00 P.M.—a turnover every 30 minutes. Thus, 13,600 cars are parked 30 minutes at central loop curbs during the average business day.

In addition, privately operated parking lots in, or contiguous to, this same area can accommodate another 700 shopping parkers. Turnover in these lots is estimated at twice daily, giving total availability of 1,400 parking spaces. In all, then, curb stalls and privately operated parking in the immediate loop lots can handle about 15,000 automobiles daily.

The two new parking ramps provide some 1,350 stalls. Downtown Auto Park officers anticipate these stalls will have a turnover of two and one-half times daily, thus accommodating some 3,375 cars each day. So the addition of these two ramps adds a significant 22½ per cent to the central loop's parking facilities.

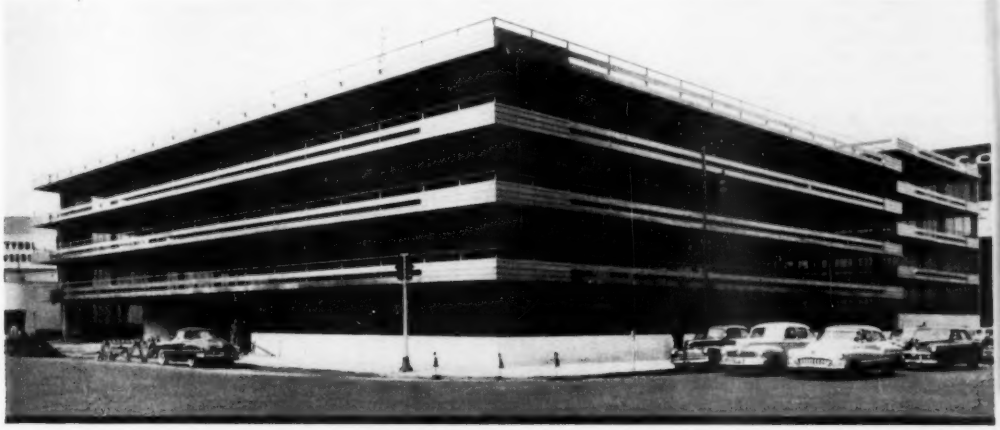
Is This Enough?

No, agree Downtown Auto Park officers and city traffic specialists. In the first place, the addition to already existing parking facilities in itself creates new demand. People in outlying areas and in the suburbs, when they find that substantial additional parking is available to them, will again flock to the loop to shop. This regeneration is expected to tax the efficient operating capacity of all off-street parking areas within a short time, thus creating the need for new parking ramps.

Secondly, statistics show a constantly increasing growth in the number of people and families in the greater Minneapolis area. More people and more families mean more automobiles. In the past five years there has been an increase of about 50 per cent in the number of passenger cars registered in Hennepin County. Suburban population growth is continuing at a vigorous rate. The volume of automobiles will grow as our suburban population grows. As the number of cars increases, traffic to the loop will increase, creating the need for additional parking in downtown areas. Thus the demand for new parking facilities will continue.

Minneapolis is progressing as fast as any other city of comparable size in the nation in the solution of its parking problems. The parking ramps are a step in the right direction, but future requirements will create the need for new off-street parking facilities. In fact, the two new ramps will satisfy only 20 per cent of the parking needs at the present time.

With traffic volume constantly on the increase, additional multi-story parking ramps will be needed to create the greatest density of parking at the most desirable spots. Such parking ramps will prove the most sensible solution to Minneapolis' future parking needs because they stack up cars and eliminate excessive maneuvering on the streets. Downtown Auto Park officers likewise believe that demand for more parking will shortly necessitate the erection of additional ramps. And when the time comes, Downtown Auto Park will provide the men and ingenuity to get the job done.



● ***THIS eight-level open parking deck has 819 stalls and accommodates more than 2,000 cars a day.***

Application of the NRC FILTER

B. N. WALTON, JR.,
Sanitary Engineer
Texas State Department of Health

ANTI-stream pollution laws of Texas state, in effect, that all waste waters shall be sufficiently stabilized, and/or sufficiently low in substances of a harmful nature that the quality of the receiving water shall not be appreciably affected. Since the flow of Texas streams is generally as erratic and unpredictable as Texas weather, dilution cannot and is not relied upon as a method of treatment. This, of course, means that complete treatment facilities are required for all sewage treatment plants, whose effluent is discharged into a water course.

Of the various types of secondary treatment devices in service, the trickling filter is of paramount importance, since installations of this type constitute about 55% of the 301 treatment plants served by conventional secondary treatment processes. These installations include filters falling into the generally recognized classifications of standard rate, single and multi-stage highrate, and a few that can be classified in neither of these categories, since their organic and hydraulic load lies somewhere between the generally defined limits of these two recognized types.

As there is a relationship between the organic load per unit of filter volume and the treating capacity of these units, the Texas State Department of Health has attempted to utilize and/or develop mathematical formulations that will be reliably applicable for predicting filter performance under the ordinary environmental conditions found in Texas. Of the various formulations that have been utilized, the filter efficiency formula developed by the National Research Council seems to give more consistently reliable results, and corresponds more nearly with actual conditions than any other curve or formula previously used.

The NRC Method

The NRC formula developed from the curve of best fit for a plot of BOD loading vs Percent BOD removal at various military installations is as follows:

For single stage filters or the first stage of multi-stage filters:

Percent efficiency filter and clarifier:

$$100 \div (1 + 0.0085) \sqrt{W \div VF}$$

Where: V = Volume of filter in acre-feet;
W = BOD load to the filter in lbs. per day; and
F = Recirculation factor.

$$F = (1 + R/I) \div (1 + 0.1\ R/I)^2$$

Where: R = Recirculation in mgd;
I = Total flow to plant mgd; and
R/I = Recirculation ratio.

For second stage filters:

Percent efficiency filter and clarifier:

$$100 \div (1 + 0.0085) \frac{\sqrt{W \div VF}}{(1 - E_1)^2}$$

Where: V = Volume of filter in acre-feet;
W = BOD load to the filter in lbs. per day;
F = Recirculation ratio (calculated as shown above); and
E_1 = Efficiency of first stage filter and intermediate clarifier.

The complete derivation of the formula may be found in the National Research Council report on *"Sewage Treatment at Military Installations"*, as reported in *Sewage Works Journal*, Sept. 1946, Vol. XVIII, No. 5.

Since the recirculation ratio or recirculation factor is included in the formula, it is equally applicable to any type of trickling filter whether it be standard or high rate or the nameless creature that lies between. This formula appears to be a common denominator, whereby the relative merits of trickling filters of all types may be weighed and compared mathematically.

Since the correlation of calculated results using the formula and actual treatment results for various trickling filters in Texas may be of interest to others, Table 1 shows some results.

Discussion

It will be noted that the actual and calculated efficiencies are not always in agreement. However, we have found that the greatest disagreement occurs in cases where single-day operation results are reported. It is felt that the formula should be applied to average operating conditions for at least a week's duration, or if possible, for monthly averages. The applicability of the formula to average operating conditions is borne out in the results enumerated for the Dallas, Fort Worth and Corpus Christi installations, all of which are calculated on monthly averages, and all of which agree very closely with actual efficiencies. These are shown in Fig. 1.

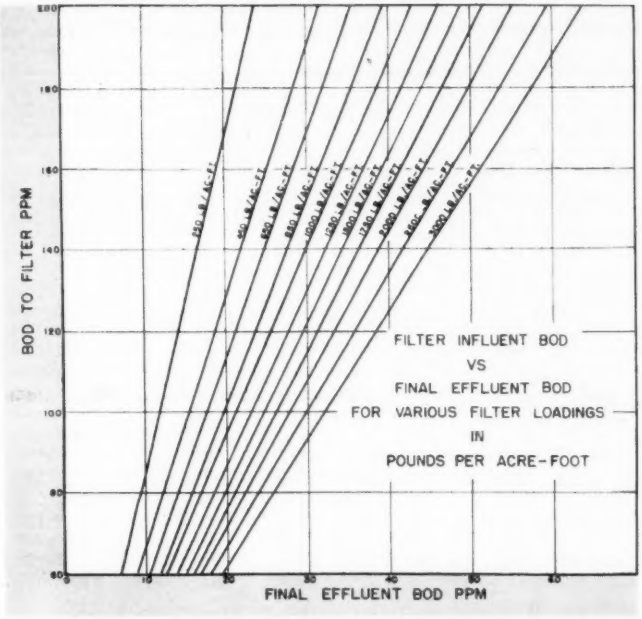
The fact that the formula is most applicable to average conditions makes it a valuable tool in predicting the operational efficiency and expected BOD removal for new installations, since most treatment plants are generally designed for average conditions. The utilization of this formula is proving most helpful, not only to the Texas State Department of Health, but also to several consulting and designing engineers throughout the State. Especially is this true in instances where the use of a roughing filter is contemplated preceding some further secondary treatment process, the design of which will depend entirely on the efficiency of the roughing filter.

As previously stated, to comply with the existing anti-stream pollution laws the highest quality effluent must be obtained. To accomplish this, consideration must not only be given to the BOD loading per unit of volume, but also the strength of the sewage applied to the filter. As an example, a trickling filter may be receiving a BOD load of 450 lbs. per acre foot, but due to an exceptionally strong raw sewage, the BOD to the filter may

be 200 ppm. Under these conditions, even though a very high reduction is obtained through the filter and clarifier, the final effluent will exceed 30 ppm. Apparently recirculation, even though it would slightly increase the filter unit loading, would provide the added treatment potential to insure the production of a satisfactory effluent. To facilitate an easy approximation of the strength of the filter influent necessary to provide a given final effluent for any particular BOD loading, calculated results using the NRC formula have been plotted and are presented in Fig. 1. Figure 2 is a plot of percent BOD reduction in the filter and final clarifier vs BOD loadings in pounds per acre-foot. The curve is a plot of the NRC formula and the various points are actually observed results for various Texas installations.

Since the NRC formula has proved to be applicable to conditions in Texas, the writer is curious to know whether it might be applied (with possible modifications) to other sections of the country, with equal success. If it were possible thus to utilize the formula, the design criteria for the various states might be standardized. The diversified methods for reporting filter performance, which upon occasion have proved to be confusing and lead to erroneous conclusions, could also be standardized. The writer feels that further consideration might be given to the operation and

EFFICIENCY FORMULA



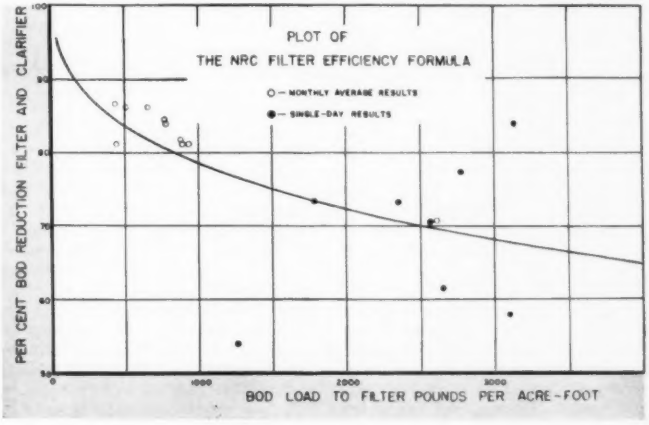
● ***STRENGTH of sewage and loading of BOD in pounds per acre foot determines the BOD of the final effluent. Fig. 1.***

performance of filters in the intermediate range between the generally established limits of standard and high-rate filtration. From observed and calculated results, it appears that filters designed for this range of operation might provide a compromise between certain economic limitations of standard-rate filters, and the generally lower efficiency of single-stage high-rate filters.

The Treatment Plants

The Corpus Christi Broadway plant was built in 1938 and increased clarification and flocculation facilities added in 1941. Existing plant units are: Mechanically cleaned screens; a detritor; two primary clarifiers, 50 ft. in diameter and 10 ft. swd; a 100-ft. diameter clariflocculator 12 ft. deep; four trickling filters each 160 ft. in diameter and 7 ft. deep, with a volume of 13.08 acre-feet and an area of 1.8 acres; two final clarifiers, 60 and 85 ft. in diameter; four digesters, 55 ft. by 23 ft. swd; and 48,500 sq. ft. of sludge drying beds.

The original plant at Dallas, built about 1917, consisted of 12 Imhoff tanks; 12 more were built in 1923. All are 33 ft. wide and 33 ft. deep;


PLOT OF
THE NRC FILTER EFFICIENCY FORMULA
O— MONTHLY AVERAGE RESULTS
●— SINGLE-DAY RESULTS
PER CENT BOD REDUCTION FILTER AND CLARIFIER
BOD LOAD TO FILTER POUNDS PER ACRE-FOOT

● ***TEXAS plant results are plotted on NRC efficiency curve. Fig. 2.***

the lengths are 48 ft. and 52 ft. More enlargements were made in 1940 and the plant now consists of (in addition to the Imhoff tanks): mechanically cleaned bar screens, a screenings grinder and mechanically cleaned grit channels; 2 50-ft. by 180-ft. primary clarifiers, 11 ft. swd; 16 trickling filters, 176 ft. by 7.5 ft. deep; 3 final clarifiers; and digesters.

The Lubbock plant, completed in 1941, was designed for a flow of 4 mgd. In addition to mechanically cleaned screens and a grinder, there are three rectangular primary clarifiers 16 by 86.25 by 8.75 ft. swd; two trickling filters, each 78 ft. by 8 ft. depth, with 10-arm rotary distributors; three final clarifiers, same as the primaries; two digesters, sludge drying beds and an irrigation farm.

The Fort Worth Plant has been added to from time to time since initial construction in 1922-23. In addition to screens, grit removal and comminution, there are five primary clarifiers, aeration tanks, three octagonal secondary clarifiers, four rectangular fixed nozzle filters; circular filters now being completed; two final clarifiers; digesters and sludge lagoons.

Fig. 1—Operating Data on Four Texas Filtration Plants

Date	V	R MGD	I MGD	R/I	F	W BOD	W/VF	BOD Ppm	% Efficiency Calcu.	% Efficiency Actual	Final Effluent Calcu.	Final Effluent Actual	MGAD Load	BOD/Sq/ft Surface
Corpus Christi (monthly averages)														
8 46	13.7	1.44	7.9	0.18	1.14	7,000	448	90	84.7	81.2	14 ppm	17 ppm	4.76	0.082
1 47	13.7	1.44	7.9	0.18	1.14	8,070	516	103	83.8	80.6	16	20	4.76	0.094
8 47	13.7	1.44	9.0	0.16	1.12	8,970	585	103	83.0	86.4	17.5	18	5.31	0.105
Dallas (monthly averages)														
1 50	70.0	2.56	31.5	0.08	1.07	63,600	942	187	79.4	81.1	38.5	35	4.58	0.165
3 30	70.0	6.6	35.2	0.19	1.14	68,000	892	176	79.7	81.2	35.8	35	5.20	0.177
4 50	70.0	6.54	31.4	0.21	1.16	68,700	885	174	79.8	81.6	35.2	32	5.31	0.179
11 50	70.0	8.74	32.4	0.27	1.20	47,600	888	182	79.7	83.0	37.0	31	4.92	0.124
12 50	70.0	8.65	36.1	0.24	1.18	59,914	934	199	79.4	84.0	41.0	28	5.00	0.156
2 51	70.0	6.43	35.0	0.18	1.14	60,131	932	206	79.4	86.0	42.0	29	4.64	0.156
Fort Worth (monthly averages)														
7 47	25.5	000	17.8	000	1.00	10,962	430	168	85.0	82.8	25.2	29	4.36	0.079
1 50	34.9	..	15.6	..	1.00	27,400	786	211	80.8	83.8	40.5	34	3.68	0.165
7 50	26.2	..	18.0	..	1.00	22,800	870	152	79.9	86.3	30.5	21	5.67	0.188
8 50	26.2	..	18.3	..	1.00	26,000	991	170	78.9	90.5	36.0	16	5.79	0.167
9 50	26.2	..	18.7	..	1.00	23,100	882	148	81.7	87.8	27.0	18	5.91	0.180
10 50	34.9	..	20.3	..	1.00	33,300	952	196	79.3	86.7	40.5	26	4.81	0.178
Lubbock (10-day average results)														
1 47	1.75	0.61	3.14	0.19	1.15	5,246	2,610	194	69.7	70.6	59	57	16.70	0.548

Twenty Years' Experience With Sanitary Fill at San Francisco

Since 1932 all household garbage and refuse in San Francisco, California has been disposed of by the sanitary fill method. The disposal site, owned by the Southern Pacific Company, is on tide flats on the shore of San Francisco Bay, just south of the San Francisco-San Mateo County Line. The area of the fill, based on a survey made by the railroad company in July, 1949, was 129.8 acres. Approximately eight additional acres are created each year, so the total area as of July 1, 1950 was about 138 acres. The owner has leased about 30 acres of the earliest filled land for commercial and light industrial purposes, and buildings have been erected having a total area of about 84,000 square feet. All of the buildings are one story only and those not built on piles are showing some signs of settlement.

Garbage and refuse is picked up at backdoors by two privately owned scavanger companies. No segregation is required on the part of the householder, but some salvaging is done by the collectors on the way to the dump. The collection trucks dump their loads near the edge of the fill in piles about 3 ft. to 5 ft. high. Two large bulldozers then push it over the edge and level up the top. Cover material brought in by trucks from adjacent quarries is then spread over the garbage to a depth of 1½ ft. to 2 ft. Additional layers may be placed from time to time after several weeks or months of settlement. The Sanitary Fill Company, which is controlled by the two scavenger companies, has leased a total area of 300 acres for fill purposes and has acquired borrow-pit and quarry rights sufficient to furnish cover material for many years. According to figures furnished by the company, the quantity of cover material used in 1949 averaged 0.76 cu. yd. per ton of garbage and refuse.

BACTERIAL-QUALITY OBJECTIVES FOR THE OHIO RIVER

BACTERIAL - quality objectives for the Ohio River have been established by the Ohio River Valley Water Sanitation Commission of which Edward J. Cleary is executive director and chief engineer. These objectives, which are shown herewith, are based on the comprehensive studies to which the Ohio River has been subjected for many years past, supplemented by new information gathered by the Commission and its signatory states. The data have been analyzed and evaluated by Harold W. Streeter and the results have been issued in booklet form by the Commission.

The limits established for potable water supply sources are premised on the desirability of a return to normal water treatment conditions, including pre- and/or post-chlorination, with minimum chlorine residuals to provide palatability and bacterial safety of the water. The recommendations for recreational waters are tentative, pending further knowledge of the epidemiology of bathing water sanitation, and are intended to provide reasonable safeguards against the more serious water-borne diseases.

Pollution Levels

The selection of these objectives involved a broad study of many factors. One of the first was an evaluation of the existing pollution levels. Such an evaluation cannot be precise to the same degree that is possible with chemical analyses of the river water. Methods now available for enumerating bacteria of the coliform group are subject to errors far beyond those involved in chemical determinations. Not only was experienced judgment and common sense essential to a sound determination of existing conditions, but these same factors must be applied in any rational application of these objectives. For instance, examination of a single sample of polluted water may give results grossly in error. According to Velz, the upper 95% confidence limit for the result of a single coliform test with three tubes planted in each dilution is 3.6 times the MPN determined from the test. If the MPN resulting from the test is 2,300 per 100 ml there is a 95% chance that the true number of organisms in the sample would range up to but not exceed 8,300 per 100 ml. An average of 25 results would theoretically narrow the range to one-fifth that for a single sample, bringing the upper 95% confidence limit to about 72% above the observed mean of the 25 results.

A source of error in evaluating coliform density in river waters to which consideration was given is that due to sampling. For ordinary catch-sampling in a well-mixed stream, the error may be 15% to 20% for a single sample. Where the stream is not well-mixed, the error may be much higher, especially if samples are collected at single midstream points. Sampling errors are generally compensatory; and their range may be greatly reduced by averaging.

Confirmed Results

A summary of the period-average and daily-maximum confirmed results of the coliform tests at the 36 sampling points of the Commission appears to indicate that at average-coliform levels of 5,000 or below, natural variability in the Ohio River tends to limit the daily-maximum to about 23,000. At all except 5 of the 36 sampling points, the maximum-to-average ratio was less than 6.0; and at 23 of the points, it was less than 5.0. At the 5 points where these ratios were exceeded, divergence was found to be due to a single exceptionally high daily result. In such cases two problems arise: Where exclusion of such high results would result in failure to meet the objective of 5,000 per 100 ml by a wide margin; and where exclusion of single high results would bring period averages approximately to the objective level. In the first case, exclusion would be immaterial; in the second, a check should be made to determine the probable cause; and this should always be done in the case of a wide departure from the normal maximum-to-average ratio.

These problems of accurate enumeration of coliform bacteria, representative sampling and evaluation of results are discussed quite fully by Mr. Streeter. The methods by which objectives for river water quality have been determined are explained at some length. Bac-

BACTERIAL QUALITY OBJECTIVES FOR THE OHIO RIVER

Potable Water Supplies

The monthly arithmetical "most probable number" of coliform organisms in waters of the river at water (plant) intakes should not exceed 5,000 per 100 ml in any month; nor exceed this number in more than 20% of the samples of such water examined during any month; nor exceed 20,000 per 100 ml in more than 5% of such samples.

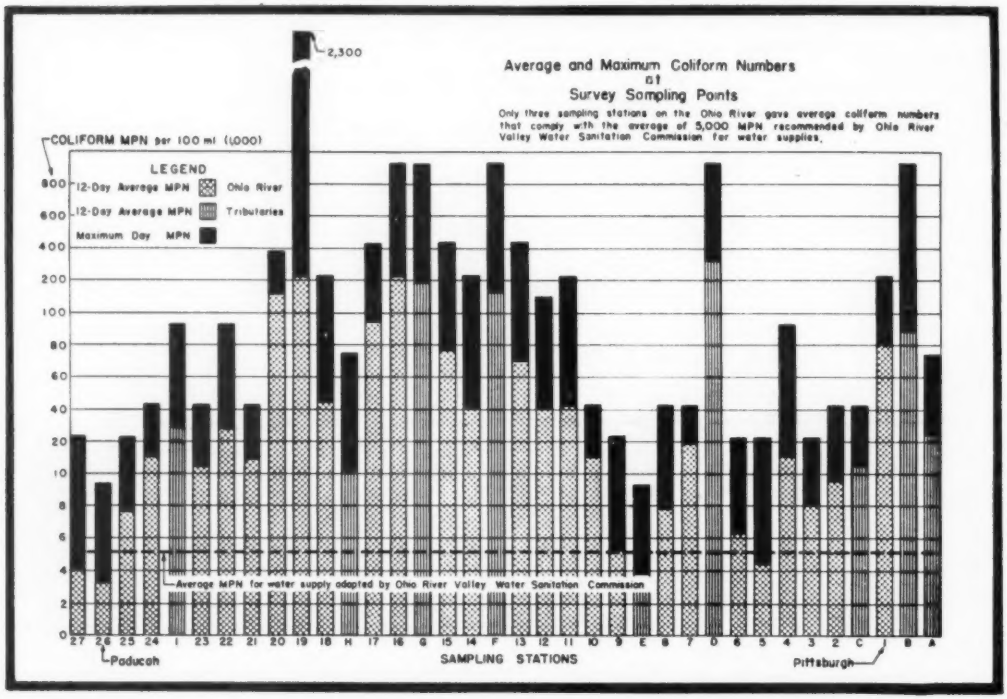
Recreational Water Uses

For bathing or swimming waters, monthly arithmetical average "most probable number" of coliform organisms should not exceed 1,000 per 100 ml during any month of the recreation season; nor exceed this number in more than 20% of the samples examined during any such month; nor exceed 2,400 per 100 ml on any day. For non-bathing or non-swimming waters, the monthly average "most probable number" of coliform organisms should not exceed 5,000 per 100 ml in any month of the recreational season; nor should exceed this number in more than 20% of the samples examined during any such month.

terial-quality standards to meet water supply requirements date back to 1914. The standard then adopted provided that the yearly average coliform bacteria index in the water delivered for treatment should not exceed 500 per 100 ml, though it was realized that the limit would be exceeded at times. The standard was based on an assumed

of prechlorination and double stage sedimentation to the other procedures would permit plants to take care of temporary overloads up to about 20,000 coliform bacteria per 100 ml. Thus two general levels of permissible raw water pollution were established observationally, the lower one applicable to normal filtration with low-residual chlo-

filtration plant design or operation. A consideration of the annual operational results at the plants studied indicates that the plants can produce effluents of average drinking water bacterial quality from estimated raw water coliform bacteria loads ranging above 30,000 and averaging roughly 40,000 per 100 ml. However, yearly averages tend to


Average and Maximum Coliform Numbers
at
Survey Sampling Points
Only three sampling stations on the Ohio River gave average coliform numbers that comply with the average of 5,000 MPN recommended by Ohio River Valley Water Sanitation Commission for water supplies.
2,300
COLIFORM MPN per 100 ml (1,000)
LEGEND
12-Day Average MPN
Ohio River
12-Day Average MPN
Tributaries
Maximum Day MPN
800
600
400
200
100
80
60
40
20
10
8
6
4
2
0
Average MPN for water supply adopted by Ohio River Valley Water Sanitation Commission
27 26 25 24 1 23 22 21 20 19 18 H 17 16 G 15 14 F 13 12 11 10 9 E 8 7 D 6 5 4 3 2 C 1 B A
Paducah
SAMPLING STATIONS
Pittsburgh

● ***AVERAGE and maximum coliform numbers reported at the sampling stations shown on opposite page.***

efficiency of coliform bacterial removal of 99.6% by the average filtration plant and the production of an effluent containing not more than 2.0 coliform bacteria per 100 ml.

Studies of USPHS

The studies of the Public Health Service, started in 1915 and continued in 1924, following an interruption by World War I, determined that, within the limits of observational error, the average rapid sand filter plant, with post-chlorination to low residuals (0.05 to 0.30 ppm by OT) could deliver an effluent with an average coliform index not exceeding 1.0 per 100 ml from raw water containing an average of not over 5,000 coliform per 100 ml.

It was also found that the addition

rination, and the higher one to the same processes plus the auxiliary measures mentioned.

In preparing this report, a study was made of six of the ten water treatment plants observed during the 1923-24 period, data comparable to that obtained previously being not available from the other four plants. Except at Ironton, yearly average coliform numbers in the raw water have increased measurably in this period of about 25 years. It was found that, despite this increased bacterial load during the more recent years, the average coliform content of the final effluents had been lower than during 1923-24. It appears that this increased bacterial efficiency is due almost wholly to more intensified chlorination and not to any material improvement in

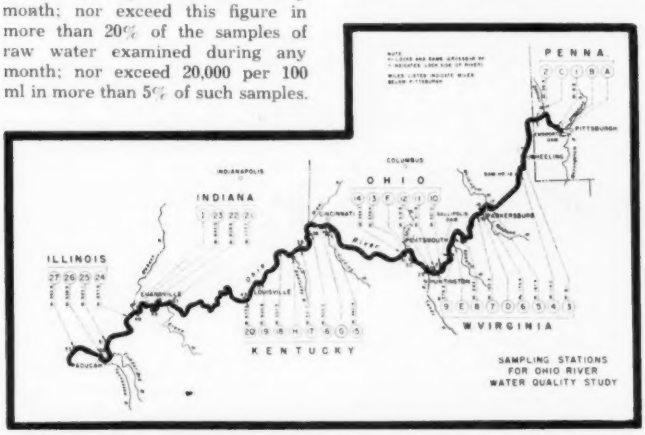
mask significant lapses in the bacterial efficiency of practically every plant studied. On the basis of the poorest month of performance, the picture is different, and the estimated safe limit of coliform loading tends to center around 10,000 per 100 ml. This limit appears to represent the load which can be handled safely under more adverse conditions of plant operation, utilizing existing facilities for high-residual chlorination.

Bacterial Quality Objectives

In establishing bacterial-quality objectives for the Ohio River to meet water supply requirements, a distinction should be made between those objectives that are desirable and those that can be tolerated. A limiting average coliform density of

10,000 per 100 ml would be safe but would involve continued dependence on intensified chlorination as an integral part of every water filter plant. This is not considered a desirable permanent condition for the nearly three million persons who depend on this river for their water supply. On the other hand, raw water containing monthly average numbers not exceeding 5,000 per 100 ml can be treated by normal filtration procedures with low-residual or "marginal" chlorination.

The recommendation was therefore made that pollution control measures along the Ohio River and its tributaries be aimed to meet an ultimate bacterial-quality objective such that the monthly arithmetical average "most probable number" of coliform bacteria in the river at all water supply intakes will not exceed 5,000 per 100 ml in any month; nor exceed this figure in more than 20% of the samples of raw water examined during any month; nor exceed 20,000 per 100 ml in more than 5% of such samples.



● ***LOCATION of sampling stations on Ohio River drainage basin.***

The period of a month was considered as the best compromise between a period so short as to involve possible large errors or so long that seasonal or other natural variations in the coliform content of the stream would exert an undue influence on the average. The use of an arithmetical average was considered desirable for a number of reasons, including the fact that every individual result has its significance in showing the average condition of a stream during short periods of time.

During the interim period while pollution control is being established, an average coliform number not exceeding 10,000 per 100 ml in any month is considered likely to maintain reasonably safe water supplies, provided present intensified chlorination practices are continued; and it is possible that plants equipped with improved coagulation-sedimentation facilities could lower chlorine residuals.

Recreational Water Objectives

In the case of bacterial-quality objectives for recreational requirements, the problem of determining a suitable objective was more difficult because there is no such adequate background of systematic observation and experiment as exists with water filtration plants. Analysis of state and regional standards does not provide any suitable basis for establishing recreational water standards for the Ohio river.

As a fresh approach, consideration was given to the findings of Kehr and Butterfield (Public Health Reports, April 9, 1943, Reprint 2469) as a rough check on the rationality of bathing water standards and of waterborne disease hazards. These studies derived a basis for correlation between morbidity rates from typhoid fever and the ratios of E. coli to E. typhosa in sewage and sewage-polluted waters. Although typhoid morbidity rates in the Ohio Valley are very low, they are measurable; and the rates for such enteric diseases as dysentery and diarrhea-enteritis are sufficiently high to indicate a carrier reservoir which might be a factor in bathing water sanitation.

Disease Rate Data

The average typhoid mortality rates for the seven Ohio Valley states for 1945-47 was 0.4 per 100,000. Assuming a morbidity-mortality ratio of 10 to 1, the morbidity rate would be 0.04 per 1,000. From the curves of Kehr and Butterfield, the corresponding ratios of E. typhosa to E. coli in sewage and sewage-polluted waters in such an area would be six E. typhosa per million coliforms, or about 170,000 coliforms to each E. typhosa. Assuming that each bather ingests 10 ml of water each day he swims, the chance of exposure can be computed for Ohio river conditions. For each bather for each day, with water containing 1,000 coliform organisms per 100 ml, the chance of ingesting a single E. typhosa would be 1 in 1700. In a 90-day bathing season, the daily swimmer would have a chance of about 1 in 19 of ingesting a single typhoid bacterium.

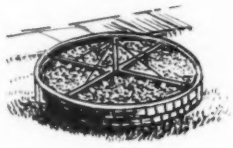
Kehr and Butterfield estimated that 2%, or one in 50, of the persons exposed to ingestion of a single E. typhosa actually contract the disease. On this basis, the chance of getting typhoid fever would be 1 in 950, for a person swimming every day for 90 days in water containing 1,000 coliform organisms per 100 ml, in an area having a typhoid morbidity rate of 4 per 100,000.

From estimates by Wolman and Gorman, it appears that waterborne diarrhea-enteritis morbidity rates tend to average about 20 times those of typhoid fever. In the seven Ohio Valley states, the ratio was 22 to 1 during 1945-47. This provides a general basis for estimating the risk of contracting such diseases in water containing 1,000 coliforms per 100 ml.

On the basis of these backgrounds of experience and data, it was recommended that, for bathing and other recreational requirements, excepting boating, the bacterial quality objectives stated elsewhere in this article should be established. The term "average" in these recommendations is intended to mean the ordinary arithmetical average. By the use of this method, the full effects of wide deviations from the average are not excluded or minimized, since in this case these are believed to be of definite public health significance.

The members of the Engineering Committee of the Commission are, as of June 1, 1951, the date of the issuance of the report: C. W. Klassen, chairman; Fred H. Waring; Earl Devendorf; F. Clark Dugan; B. A. Poole; H. E. Moses; M. LeBosquet; W. W. Towne; Edgar Landenberger; O. Lloyd Meehan; Harry K. Gidley; and Richard Messer.

PRE-TREATMENT OF MILK WASTES REDUCES TREATMENT PLANT LOAD



PHILIP S. DAVY
Davy Engrg. Co., La Crosse, Wisc.

PLANS and specifications for a sewer system and a treatment plant for the Village of Spencer, Wisc., were prepared by our firm in 1941. In February, 1942, construction work was stopped because of war conditions. At that time, the sewer work was partly complete and many items of equipment were on hand for the treatment plant.

When work could be resumed in late 1946, the local milk processing plant had been increased in size to the point where the sewage treatment plant, if constructed on the basis of original design, would not have been adequate in capacity. However, the equipment purchased and paid for in 1942 could not have been used if the plant were expanded materially in size. To overcome these difficulties, a pre-treatment plant was designed to provide partial treatment for the milk plant wastes before discharge into the Village sewer system.

Design data for the milk plant waste treatment was based on peak intake during the flush, as follows: Peak intake, 60,000 lbs. of milk per day; waste flow, 15,000 gpd; BOD output 206 lbs.; and population equivalent 1,236 persons. The design load for the pre-treatment filters was set at 3.64 lbs. of BOD per cu. yd. of filter media or 135 lbs. per 1,000 cu. ft., with minimum dosage at the rate of 10 mgad or 58,200 gpd.

The Pre-Treatment Plant

The pre-treatment plant consists of a holding tank to store the milk wastes as received and permit their release to the Village plant over 16 to 24 hours per day. There are two sewage lift pumps, with high and low level controls. The high rate filter is 18 ft. in diameter and 6 ft. in depth, with field stone filter media 3-in. to 4-in. in size. Two adjustable weirs are provided at the filter outlet for return recirculation to the holding tank and for treated waste to the Village plant. No settling facilities are provided at the pre-treatment plant. The milk waste is applied directly to the high rate filter and the filter effluent goes to the Village plant.

One of the problems in milk waste treatment is the variation between minimum, average and maximum rates of intake, with the consequent fluctuation in waste production. The provision of two recirculation pumps and of adjustable weirs makes it possible to vary the number of passes to the filter and to reduce the power bill at times of low production.

It was estimated that the treatment provided would accomplish a reduction of about 50% in the milk waste BOD. Tests performed in cooperation with the State Board of Health in June, 1949, showed the following:

Raw wastes: Average flow 9.27 gpm; total flow 13,330 gpd; maximum flow 27.5 gpm; minimum flow 2 gpm; BOD 826 ppm or 92.5 lbs., with a population equivalent of 555 persons. The flow to the filter, including recirculation, was 71,500 gpd; the recirculation ratio 5.35, and the rate of application 12.3 mgad. The BOD of the unsettled filter effluent was 396 ppm, with 44 lbs. of BOD, indicating a reduction of 52%. This was considered adequate; and it could be increased by additional recirculation.

The construction cost of this pre-treatment plant was $9,227, exclusive of land and engineering.

The Village Plant

The Village treatment plant received the normal domestic wastes of the community, plus minor industrial loads due to slaughtering in conjunction with locker plants and the unsettled wastes from the milk pre-treatment plant. The Village plant consists of a screen chamber, primary clarifier, wet pit and dry pit housing sewage pumps, a standard rate trickling filter and a final clarifier. Provisions are made to return final effluent to the wet well for recirculation. The primary, secondary, sludge digester and wet and dry wells are housed in a single building. Sludge drying is on a standard type bed. The filter is 56 ft. in diameter and 8 ft. in depth.

The loading on the plant, as indicated by the June, 1949, tests, including unsettled wastes from the pre-treatment plant, was: Average flow 52 gpm; total flow 74,900 gpd; maximum flow 81 gpm; minimum flow 27.5 gpm; BOD 323 ppm, or 208 lbs. per day. The BOD of the effluent, without employing recirculation was 65 ppm or 40.5 lbs. per day. The overall efficiency of the plant was 80.5%. During the test period, recirculation was not employed, nor was there any change in the routine of the part-time operator.

The total cost of the Village treatment plant was $36,919 and of the pre-treatment plant $9,227. On the basis of an equivalent population of 2,136 served by the plant, the cost per capita amounted to $21.60. Operating results since completion and testing have remained at a very satisfactory level.

• • •

Water Shed Control Practice

The Metropolitan Dist. of Hartford County, Conn., operates 8 reservoirs, fed from 100.4 sq. mi. of watershed, of which 30.5 sq. mi. is owned by the District. A forester is in charge of the forested watershed and under his direction merchantable trees are marked for cutting and sold on the stump to the biggest bidder or cut by the Water Bureau forces and sold as logs. During 1950, 359,000 fbm of standing timber was sold for $5,603 and 167,825 fbm of cut logs yielded $6,895.25; $1,408.65 was received for posts and cordwood.

The Bureau encourages the use of its watersheds for recreation, fishing and picnicking. One reservoir was stocked in 1950 with 10,600 trout, and 22 boats are rented for fishing, some 6,100 fishermen using them last year. During the blueberry season the Bureau's lands were opened to pickers at a fee of $1.00 per head, which yielded a revenue of $842 in 1950.

● ***DEAD Man's Rock is typical of area in which the investigations were carried on.***

RADIOACTIVE ISOTOPES TRACE UNDERGROUND WATERS

SIR CYRIL SANKEY FOX
British Consulting Mining Geologist

MY investigations in the Wadi Raiyan, in the Libyan or Western Desert of Egypt, on the southwestern borders of the famous Faiyum basin, were primarily concerned with the problem of the water-tightness of a proposed reservoir site which the sand-laden winds had scoured during countless centuries.

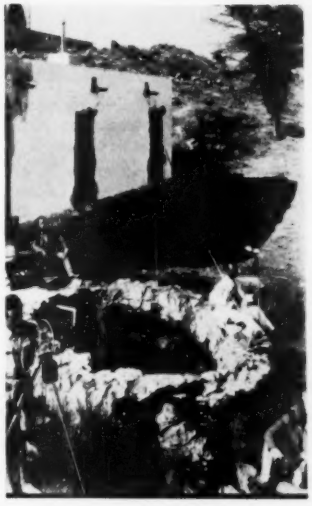
There were several questions involved in the general problem: Direct leakage into the rich Faiyum; losses down mineralized fault fissures; and absorption into the strata forming the floor of the natural reservoir-concavity. The first two questions were dealt with by direct experiment for infiltration from bore holes, which were lined with perforated pipes and fed with silty water. The question of losses by percolation through the exposed floor of almost flat-lying beds of limestone, marls, and shaly clays was the most difficult to deal with.

The catchment area—if I may use the name for an almost rainless region—of the Wadi Raiyan is, roughly, 400 square miles, with a maximum depth of 300 feet (nearly 200 feet below sea level from the 100 foot contour). When filled to the 100-foot contour above sea level, the reservoir lake will have a water-area of nearly 300 square miles. The annual loss by evaporation was computed, roughly, at between six and nine feet. This I considered too high in itself; and it might become a serious factor if the percolation into the rock floor should be equal to or greater each year than the evaporation.

● ***AIN el Bahariya, famous spring in Egypt's western desert where radioactive rubidium chloride was used.***

There are three fresh-water springs in the south-west corner of the Wadi Raiyan, at about the 80-foot contour (above sea level). Their total discharge probably does not exceed ten gallons per minute, say 900,000 cubic feet annually. This would not cover a square mile to a depth of half an inch.

The nearest and weakest of the springs is about seven miles from the deepest part of the basin. The water from each of the springs disappears into the ground within a few yards of its point of emergence. There are damp sands in the deepest part of the basin, and brine occurs in the sands at a shallow depth. In such an arid region it would seem astonishing that the spring water could travel in the subsoil to the brine-carrying sands. About three miles south of the sands and at a slightly higher level, there are five low mound-springs which merely seep brine and give off an odor of sulphuretted hydrogen. Except for rare run-off rain, there appears to be no other source



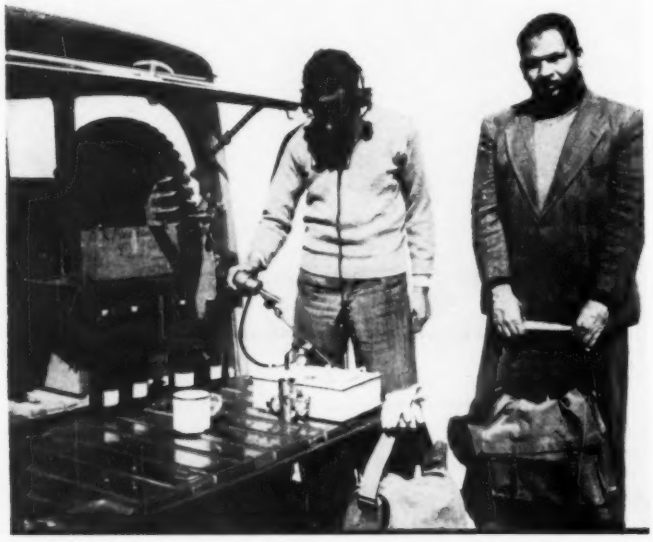
● ***RADIOACTIVE thermal spring in Abyssinia gave the author the idea of using this test.***

of water to replenish the brine in the sands, other than the three springs, at least seven miles away. The evidence suggested that the floor of the reservoir must be water-tight.

Need For More Evidence

However, there remained a doubt as to whether the subsoil percolation could suffer even so trifling a loss under such conditions. Any percolating water in the subsoil will take up salt, which is carried in by the northerly winds and settles with the dust. This would explain the brine in the sands and, further, would support the belief in the water-tight character of the basin floor. Nevertheless, I felt the matter must be supported by further evidence of a more direct kind, and I considered the use of a suitable kind of "marking" which could be traced with certainty. As the subsoil water must encounter limestones, gypsum and salt on its journey from the springs to the sands, my marking chemical should remain in solution in the water and should not be precipitated or absorbed by any of the above mentioned rocks and minerals; and it must remain identifiable in the brine.

I considered the coloring agent, methylene blue, but felt that the dilution of this thiazine dyestuff would so weaken the color that it might not be recognized in the brine. For similar reasons I was not prepared to utilize fluorescein, and in this case I was not sure that its green fluorescence would be detectable in the brine in one of the hollows which I had scooped out in the sand. Using some distinctive chemical, say rubidium chloride, would involve a large quantity of the substance, if there was to be any hope of detecting it by chemical analysis, in the samples of brine I might collect over a period of days (to allow time for the spring water to percolate the distance to the sands). I remembered the delicate tests I had made with an electroscope on the radioactive thermal springs of Errer in the Rift Valley of Abyssinia some years ago.



● ***TESTING the brine recovered from underflow in Egypt's western desert. Beta ray detector in tester's right hand.***

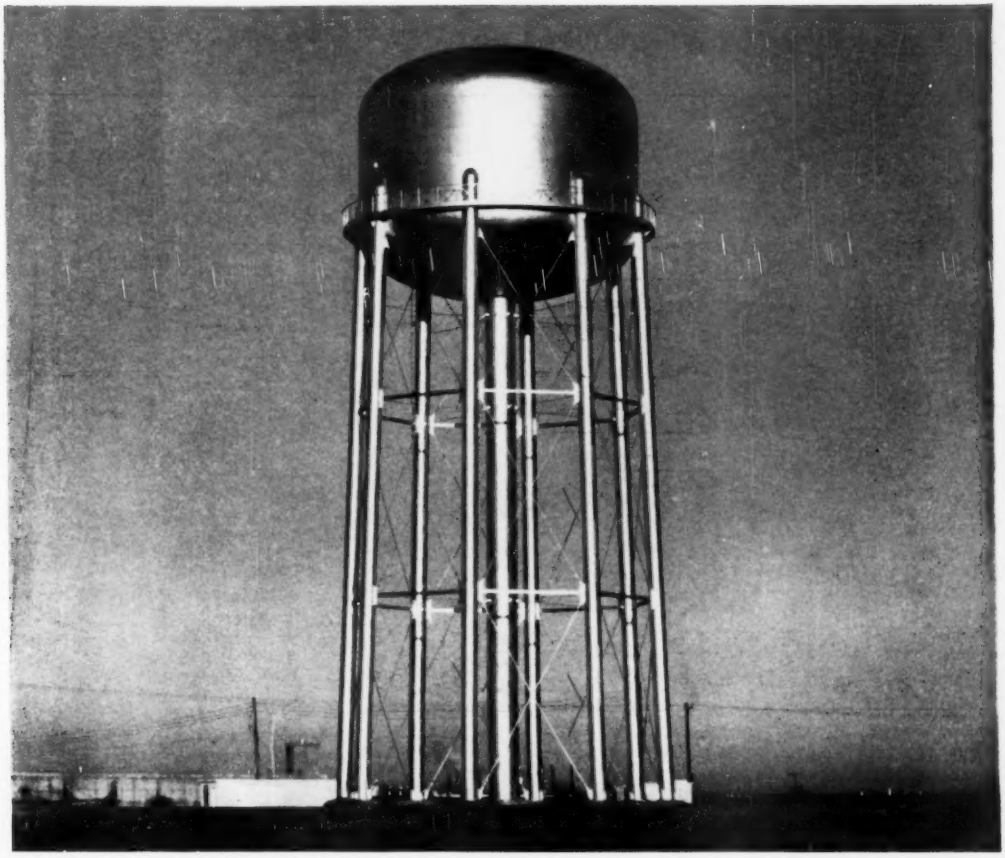
It occurred to me that, if I could utilize a radioactive isotope of a suitable element, with a satisfactory length of half-life, I might get the decisive data I desired. I took my problem to Messrs. Fearnside and Jones of Isotope Developments Limited, London, and they selected rubidium chloride as the most suitable salt, and arranged with Britain's Atomic Energy Research Establishment at Harwell for a small quantity of this substance to be "cooked" in the atomic reactor and made radioactive. The half-life of rubidium 86 is about 19 days, which gave ample time for the isotope to be flown to Cairo, where I would collect it. Messrs. Fearnside and Jones, furthermore, built me an instrument (Isotope Developments Limited call it the "water monitor"), with which I could detect the Betarays (electrons) ejected from the radioactive rubidium I should use as a "tracer."

Three Solutions

I was informed by cable when the isotope was despatched from London and I took delivery of it the same night at Farouk Air Port, Cairo. By 2 next morning I had everything ready at Faiyum for proceeding to the Wadi Raiyan springs nearly 40 miles away in the desert. We left at 6 a.m. and arrived at the most north-easterly spring, Ain el Bahariya, before noon. There, inside a station-wagon, I prepared the three standard solutions from a ten per cent solution of radioactive rubidium chloride—(1) strong, one cubic centimetre of the ten per cent solution in a litre of distilled water; (2) medium, one cubic centimetre of (1) in a litre; and (3) weak, one cubic centimetre of (2) in a litre—and finally poured the ten per cent solution into the spring water at the point where it was itself disappearing into the ground. I had, of course, previously tested the spring water and the brine in the dip, and found both similar to a "background" of distilled water.

Five days after placing the radioactive isotope in the Bahariya spring, I re-visited the sands and re-tested the brine (again against a "background" of distilled water). In each of the five tests, after repeated washings with distilled water between each, I found the brine was distinctly more radioactive than the distilled water. In spite of the weakness due to the extreme dilution it had suffered, and the decay in radioactivity in the time, the brine was nevertheless more radioactive than solution (3), but weaker than solution (2).

Since then I have felt justified in assuming that the floor of the Wadi Raiyan will, after it has become wet, prove absolutely water-tight against absorption and percolation. The borings in the northern part of the Wadi Raiyan had, by the behavior of the water used for drilling, already shown the same strata to be relatively impervious.



Solving Water Problems in Texas' South Plains

Good irrigation, good soil, and plenty of oil are transforming the once comparatively unproductive South Plains of Texas into an area of booming cities and prosperous farms.

Levelland, Texas, stands out among these communities both for its growth and its prosperity.

Where thirty years ago there were only 137 people in the county, there are now 11,000 in Levelland alone. And where there were once only scattered farms and ranches, there are now flowing oil wells and neatly plowed rows of King Cotton.

However, such a rapidly growing city is naturally faced with water problems . . . especially in the newer sections. Low pressures, pressure variations, and high pumping costs are most common.

Recently, Levelland installed a Horton elevated water tank to alleviate these problems. This 400,000 gallon structure helps supply clear well water to 2300 customers. And equally important is the fact that it is a dependable water supply . . . because it's backed by gravity pressure.

Tanks of the ellipsoidal design are built in sizes ranging from 15,000 to 500,000 gallons. Tanks with radial cone bottoms in sizes from 500,000 to 3,000,000 gallons.

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Philadelphia 3...1648-1700 Walnut St., Bldg.
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Bladeless Trash Pumps Cure Sewage Pumping Problems

TWO of the first FM bladeless trash pumps to go into regular service in the field have solved a difficult sewage handling problem for the Baltimore County Metropolitan District. They have converted a trouble spot that required servicing every day in the year into a completely automatic pumping station.

The Joppa Road Pumping Station at Towson, Maryland has a capacity of 500 000 gpd. It gathers sewage from a broad area and pumps it to the treatment plant. Most of the area served is residential but two factors make Joppa the headache of the system. First, five industrial plants discharge a variety of difficult waste products into the line. Second, and most important, a nearby tuberculosis hospital sends through the pumps a large volume of rags, towels, bandages, and cotton. Actually, a high percentage of the sewage handled by this station contains the kind of fibrous solids that tend to clog pumps.

The pumps originally installed in 1941 could not handle these wastes. Though designed as an automatic station, it was necessary to visit the station twice a day to remove towels and other waste.

The two new pumps are 4-in. 320-gpm FM bladeless horizontal trash pumps. These were direct-connected to 15 hp., 1750 r.p.m. motors already in the Joppa Station. The pumps were installed on January 12, 1950, and have been in continuous operation ever since. Not only does the same type of sewage pass through the station but the quantity has increased greatly in the past year. According to Berley Ambrose, Supt. of Maintenance, there has not been a single instance of pump clogging or a minute's operating time lost. In fact, the handholes on both pumps have never been opened to clear the impeller passageway since the pumps were installed.

At this writing, each of the two pumps has been in service nearly 14,000 hours without clogging. Today, Joppa Road Station is completely automatic. There is no operator in attendance and the only servicing required is to lubricate the equipment once every four or five months. Pumps and motors are housed in an underground concrete chamber and residents of the area probably are unaware that the station exists. But the pumps with their bladeless impellers are in continuous service, doing unfailingly one of the toughest jobs a sewage pump can be called on to perform. And they have eliminated already more than 1,000 service visits.

ROY JOHNSON

● *INTERIOR of Joppa pumping station showing bladeless pumps.*

• • •

Renting Curb Space for Night-time Parking

Some time ago it was noted that Milwaukee, Wisc., was issuing permits for night-time curb parking and charging for these. Permits are issued when the police department finds that no parking lot or garage is available within two blocks of the person's residence. The permit costs $4 and is good for a month. Different colored stickers are used for each month. The revenue is earmarked for the development of off-street parking lots. In the first 15 months this procedure has been in force, the city has collected slightly over $330,000.

Another city that rents curb space for overnight parking is Monterey Park, Calif. A parking permit sticker must be obtained which costs $7.50 and is good for 6 months. Permits are granted only where there is a lack of garage or lot parking space.

• • •

Collects 99.6% of Water Bills

During the ten years 1941-1950, the Water Bureau of Hartford, Conn., has collected all but about 0.4% of the $17,052,626 water rents billed; the records for four of these years show the cash received to have been greater than the bills rendered. More than 96% of the services are metered. About 20% of the water sales were to industries.

WHAT'S A WHOLESALER?

At the end of every production line rises the greatest single responsibility of business—the profitable distribution of a product. So important is this responsibility that men all over the world dedicate their minds, money, voices, hands, eyes, ears, noses, nerves, and sometimes their very lives to its fulfillment.

As a group these men are termed "Salesmen", "Representatives", "Agents" and "Reps". They are called other things frequently.

So intent are they on marketing their products successfully, and so dire are the consequences if they don't, that they solicit the help of one of the most singularly important influences in the distribution cycle—the wholesaler.

The wholesaler has been known as a "Jobber", "Distributor", "Dealer" and smiles more often when called a wholesaler than by any other name.

He is linked to reputable manufacturers by supply, to their salesmen by merchandising, to his family by love, his employees by loyalty and to his customers by outstanding service and friendship.

He places more orders, receives more merchandise in greater variety, stocks and restocks more shelves, makes more shipments in less time, holds more confidences and credit across longer counters with a larger capital investment in a smaller area than does either his suppliers or his customers.

Every day he dispenses more information on a wider variety of products than is provided in the literature furnished him. It is taken from years of experience and is added to the knowledge of the craftsmen who are his customers.

The wholesaler can be counted among the members of leading associations, civic groups, fraternal orders, religious societies, country clubs and bowling leagues. His divergent interests compel him to be up early and out late. His favorite but rare relaxations are found at home, on vacation, with a fishing rod or behind a bird dog; at a card table and over a cup of coffee with Joe around the corner.

The wholesaler is not typically a small businessman, neither is he a tycoon; rather, he is a well established, highly regarded commercial institution; sincere, practical, reliable; and on his shoulders rests the production lines of tomorrow—profitable distribution today.

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PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

SEWERAGE AND REFUSE . . 62
HIGHWAYS AND AIRPORTS . . 69
WATER WORKS . . 74

THE SEWERAGE AND REFUSE DIGEST

Algae in Oxidation Ponds

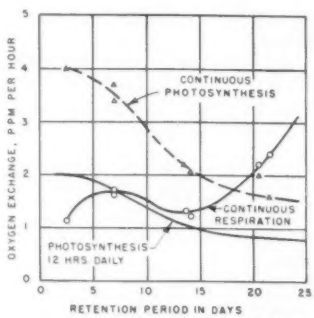
Oxidation ponds effect biological stabilization of settled sewage and industrial wastes by means of oxygen absorbed from the air, supplemented by oxygen produced by algae through photosynthesis. The treatment effected by an oxidation pond results from a complex symbiosis of bacteria and algae. The principal work of treatment is accomplished by aerobic bacteria, which oxidize the organic carbon contained in the sewage to carbon dioxide. The algae, through photosynthesis, convert much of this carbon dioxide to algal cell material. Therefore the pond effluent may contain as much organic material as did the sewage entering it, but highly stable and having no pathogenic significance; and, if discharged to watercourses, may promote the growth of fish and other wildlife.

E. gracilis cells under favorable conditions grow and reproduce rapidly and photosynthesize much more oxygen than they respire. Under unfavorable conditions (insufficiency of nutrients and light) however, they grow and reproduce slowly, produce less oxygen than they respire, and tend to settle out and adhere to bottom surfaces. Favorable conditions usually exist in sewage oxidation ponds and in polluted streams. Algae growing in ponds absorb ammonia and other forms of nitrogen from the sewage and thus may be considered a means for reclaiming this waste nitrogen. The algal cell material is a high protein food, probably suitable for cattle. The probable maximum yield of *Euglens* from sewage, fortified with carbon dioxide to permit maximum reclamation of the available nitrogen and subjected to continuous lighting, is estimated to be 0.26 g. per liter of sewage per day.

Harry F. Ludwig, Wm. J. Oswald, H. B. Gotaas and Victoria Lynd—"Algae Symbiosis in Oxidation Ponds:" *Sewage and Industrial Wastes*, November.

Standards for Pollutional Discharge

"Percent removal" of BOD or other characteristics of sewage is a convenient measure of the efficiency of a treatment plant, but in deciding whether a plant effluent is conditioned sufficiently to permit its discharge into a given stream, amount of objectionable matter or condition remaining in the effluent is the real consideration, taken in combination with the class of the receiving stream and its volume or other self-purifying characteristics. Knowing the original characteristics of the sewage, amount remaining is deducible from "percent removal."



Courtesy Sew. & Ind. Wastes

● *OXYGEN uptake data.*

For industrial wastes in general, percent removal cannot be used as a criterion: 95% removal from some would still leave an impermissible amount of pollution, while from others 10% removal might be permissible. The requirements for industrial trade waste effluents should be:

1. The turbidity should be at least as low as that required for sewage effluents.
2. The BOD should be at least as low as that required for sewage effluents.
3. The character of the industrial waste effluent will have to be carefully considered, both as to composition and effects. Each component must be properly evaluated. Toxic, or otherwise objectionable constituents, will have to be reduced to a point of tolerance, depending upon either the substance itself or the uses of the stream. No general rule can be set forth.

F. E. Daniels—"Rational Standards for Pollutional Discharges;" *PUBLIC WORKS*, December.

Shape of Filter Media

Sponsored by the Dresser Trap Rock Co. of Minneapolis, the Sanitary Eng. Div., Dept. of Civil Engineering, Univ. of Minnesota has conducted a research into the effect of the shape of the stones in forming the medium of a trickling filter on the porosity and surface areas of such medium, especially the effect of flat or elongated particles. The material studied was limited to trap rock. The term "shape ratio" is used to indicate the quotient obtained by dividing the greatest major dimension (length) by the least dimension perpendicular to the long

The right combination

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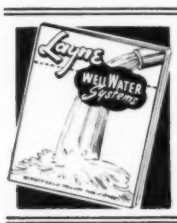

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axis (thickness). A perfect cube would have a shape ratio of 1. The stones of the various samples had an average median size between 2.75 and 3.20, and the shape ratios were divided into classes of 1 to 2, 2 to 3, 3 to 4 and 4 to 5. The average voids varied from 49.0% for the 1 to 2 class to 54.7 for the 4 to 5 class. The surface area in sq. ft. per cu. ft. varied from 15.8 for the 1 to 2 class, to 19.2 for the 4 to 5 class. Investigations by others of results obtained by filters with surface areas differing from 20 to 80 sq. ft. per cu. ft. showed reductions of BOD differing by about 8%, or 1 1/3% for a difference of 10 sq. ft. per cu. ft.; a difference of less than 1% in BOD reduction between all the shapes considered in this study. However, where there are many flat stones they may pile upon each other with the large surfaces in contact and therefore ineffective.

George J. Schroepfer—"Effect of Particle Shape on Porosity and Surface Area of Trickling Filter Media;" *Sewage and Industrial Wastes*, November.

Corrosion-Resistant Surface Protection Materials

In selecting paints or other materials for protecting the surface of steel, masonry or wood in waste treatment plants from corrosion, consideration should be given to the temperature of the wastes in the plant, its acidity or alkalinity and concentration, whether the treatment will produce splashing or fumes; properties of the materials to be covered and the surface preparation necessary. Concerning the covering materials, he should investigate the composition, coverage, drying requirements, finish, tolerance of scrubbing and other maintenance methods; flexibility; adhesion; abrasion, electrical, temperature, weather, acid, alkali, solvent, salt and oil resistance; inflammability; thermoconductivity; water absorption, film thickness, toxicity to application crew, and total annual cost, including maintenance and effective life.

Walter J. Sandel—"Selection of Corrosion-Resistant Materials for Waste Treatment Plants;" *Sewage and Industrial Wastes*, November.

Alternating Double and High-Rate Filtration

At the Minworth works of the Birmingham Tame and Rea District (England) experience with four similar filters, in one pair of which the distributor rotated once in one to four minutes, in another pair regularly once in 8 minutes, indicates the slower rate had no serious adverse effect on the performance or condition of the filters. In another experiment with filters worked at rates of from 100 to 1,000 gal. per cu. yd. per day of settled sewage having a BOD of about 170 ppm, while the filters taking the heavier dosages have not produced such good effluents as the more lightly dosed ones, they produced effluents averaging 60 ppm of BOD as compared to 25 ppm by the more lightly dosed ones. However, all of the heavily dosed filters, except one with coarse medium, ponded badly and had to be forked at short intervals. Which would seem to indicate that the use of a coarse medium is a better all-around proposition for high-rate single filtration.

"Light on Filtration Problems in WPR Report;" *Municipal Engineering*, Nov. 16.

Ozonation of Cyanide Wastes

The methods now in use for treating cyanide wastes are acidification, chemical precipitation, and chlorination. Acidification evolves highly toxic cyanide gas. Precipitation creates a sludge problem. Chlorination requires accurate controls, and chlorine residual is as toxic to fish as is cyanide. The authors found that cyanide wastes can be treated satisfactorily and economically by ozonation, the cyanide being oxidized through cyanate to nitrogen gas and bicarbonate. Exhaust air from the treatment plant should be vented from the building to prevent deterioration of rubber insulation or equipment parts.

Richard G. Tyler, Wm. Maske, M. J. Westin and Willard Matthews—"Ozonation of Cyanide Wastes;" *Sewage and Industrial Wastes*, September.

Direct Method for Determining BOD

The standard dilution method for determining the BOD of sewage and industrial wastes has several disadvantages which affect its use for studying problems concerning treatment of sewage and industrial wastes, as well as for determining their BOD, among the most important of which are the low solubility of oxygen in water and the tediousness of the procedure. There is need of a direct method for continuous measurement of oxygen utilization which will enable the determination of BOD and the study of various factors affecting biological oxidation at concentrations similar to those encountered under treatment conditions. By "direct" method is meant a method whereby the BOD of a waste sample is determined by placing it under an atmosphere of air or oxygen in a closed system under conditions of constant agitation and temperature. The oxygen utilization is measured at any given time interval by calculating the decrease in gas volume directly or from change in pressure while maintaining constant volume. The authors state conclusions drawn from experiments dealing with a CO_2 absorption modification for the Sierp apparatus and modifications of the standard method, from which they have developed a proposed method for direct measurement.

I. Gellman and H. Heulekekian—"Direct Method for Determining BOD;" *Sewage and Industrial Wastes*, October.

Determining Color In Industrial Wastes

The authors describe a simplified and less costly method for the filter-photometric determination of industrial waste color characteristics, using tristimulus light filters combined with a specific light source and photoelectric cell. The results obtained are approximately the same as with a spectrophotometric method.

Willem Rudolfs and William D. Hanlon — "Color in Industrial Wastes"; *Sewage and Industrial Wastes*, October.

Concentrating Activated Sludge

The Cleveland, Ohio, Easterly and Southerly plants use two different and rather unusual procedures for concentration of waste activated sludge. At the Easterly plant, two of the 16 tanks designed for final clarifiers have been used for concentrating sludge for the past seven years, without odors or nuisance of any kind. The amount of mixed liquor (not sludge only) fed to these concentrating tanks is controlled by their influent gates; these tanks in effect "floating" on the connected aeration tank system and automatically holding the suspended solids in the mixed liquor within a narrow band of minimum and maximum. Best results have been obtained when the rate of feed averaged

400 gpd per sq. ft. of surface area. The application of chlorine to the feed affected the process adversely. The concentration tank overflow can be controlled so that it approaches the quality of typical plant effluent; the suspended solids need not exceed 30 ppm. The concentration of mixed liquor in an environment of dissolved oxygen or nitrate will produce a thickened sludge containing approximately 30,000 ppm of total solids on a yearly average basis. Odor nuisance can be completely eliminated.

At the Southerly plant, Imhoff tanks are used and the lower digestion chambers would not operate well if the waste activated sludge were added to them. This sludge is concentrated in 47,900-gal. Dortmund tanks before digesting it. Normally, two Dortmund tanks are filled with waste activated sludge twice a day. The average sedimentation time for concentration is 7½ hr. for the total of 191,960 gal. concentrated each day. In 1950 the reduction in gallonage averaged 37.9%, with 98.0% of the solids retained. The dry solids content was raised from 1.72% in the waste activated sludge to 2.70% in the concentrate. The concentrated sludge is drawn off to digestion tanks, usually at 12-hr. intervals, and the supernatant is pumped to the incoming sewage. The tanks are then filled, which takes about an hour; stand full for 7½ hr.; and emptying takes about 2½ hr.

John J. Wirts, Frank J. Ausflug and Clyde E. Kirsch—"Concentration of Activated Sludge;" *Sewage and Industrial Wastes*, October.

Sludge Treatment At San Francisco

There are now under construction by San Francisco two plants, the North Point and the Southeast. The latter has bar screens, grit chambers and aeration sedimentation tanks to treat an average dry-weather flow of 30 mgd. The North Point plant will provide primary treatment for 60 mgd. The sludge from both plants and also that from the 20 mgd Richmond-Sunset plant will be treated in a single plant located near the Southeast plant, the sludge from the North Point plant being pumped through 5.93 miles of 10-in. main and filter cake from the Richmond-Sunset plant being trucked there for final treatment. This will consist of thickening the raw sludge, digestion, elutriation, vacuum filtration and heat drying of filter cake to produce a dried sludge of about 8% moisture content which will be sold for fertilizer. There are ten digesters, six for primary and four for secondary digestion. There will be a gas holder 56 ft. in diameter and 20 ft. high, four primary and four secondary elutriation tanks, and four 8 x 14 ft. vacuum filters. A dryer building houses three Raymond dryers rated at 6,250 lb. of water per hour, and space for sacking and storing the dried sludge. The sludge force main bringing sludge from the North Point plant contains 4 blow-off vaults and 10 drain and clean-out vaults, each with a 2-in. blow-off connection and provision for draining the contents of the sludge line into a sewer in case of emergency.

"Sewage Project Includes Special Sludge Treatment Plant;" *PUBLIC WORKS*, November.

Overloading Standard-Rate Filters

Various researches into the effect of overloading filters have, in every case, demonstrated that the ability of the standard-rate trickling filter to perform satisfactorily under in-

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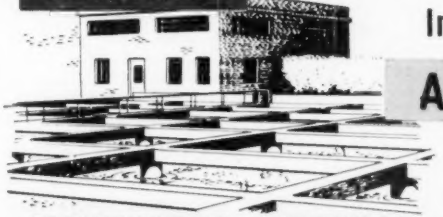

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creased loading has been underestimated; largely because estimates of efficiency were formerly based largely on the degree of nitrification effected. Experiments have been conducted at the University of Florida with a 6-ft. deep, slag-filled filter at rates between 5 and 20 mgad of settled domestic sewage with no recirculation. The following conclusions are drawn from the results of this test:

1—A standard rate trickling filter operated under certain conditions of organic and hydraulic overload can be expected to reduce BOD with little or no decrease in efficiency and without operational difficulties. Certain combinations of high organic loading and hydraulic loading may cause a tendency to clog the bed. Organic loadings over 2,500 lb. per acre-foot per day at hydraulic loadings of 10 to 12.5 mgad should be avoided. 2—Nitrification of the filter effluent decreases as the organic and hydraulic loading increases. 3—Reasonable suspended solids concentration in the settled effluent was obtained at all ranges of loading used in this test. 4—The action is that of flocculation as well as oxidation, with the former predominant at shallow levels and in the loading range where clogging may be anticipated. 5—The mild temperature of both air and sewage throughout the test prevented conclusions as to the effect of temperature; but during an 8-day period when the average air temperature decreased from 64° to 50° and that of the filter effluent from 75° to 67°, the reduction in applied BOD dropped from 70.7% to 64.7%, and the nitrification from 3.3% to 3.1%.

G. R. Grantham—"Trickling Filter Performance at Intermediate Loading Rates;" *Sewage and Industrial Wastes*, October.

Toxicity of Industrial Wastes to Fish

The toxicity of a given waste or other water pollutants to fish can best be determined by bio-assay methods. This permits determining what concentrations are harmless to fish life, and, in a case of such damage, whether it was due to a particular waste, waste component, or combination of wastes. To permit comparison of results, reproducibility and general usefulness of bio-assay methods, it is desirable to establish a standard procedure, and one is offered by the author based on the experience of many investigators. Different kinds of fish are not equally susceptible to toxic substances. The author's outline of procedure includes the choice and preparation of test fish; selection and preparation of the experimental water; number of fish used and other conditions; the test procedure; and reporting, interpretation and use of the results. The "Care and Feeding of Test Animals" and "Suggested Experimental Concentrations" are described in Appendices.

Committee on Toxicity, Federation of Sewage and Industrial Wastes Associations — "Bio-assay Methods for the Evaluation of Acute Toxicity of Industrial Wastes to Fish:" *Sewage and Industrial Wastes*, November.

Removing Roots from Sewers

In connection with sewer maintenance at Marshall, Mich., City Engr. Victor D. Camp has used flake calcium chloride and rock salt for killing roots that have grown into sewers. From one-half bag to a bag of chloride is dumped into a manhole, followed by a 50-gal. drum of water; the resulting brine solution kills the fibrous live roots. In one case the roots were found to be dead for at least 6 in. outside the pipe. A certain 8-in. lateral had given continual root trouble until a pickle company began operating and dumping their salt vats into the sewer, after which root trouble ceased.

Victor D. Camp—"Sewer Maintenance at Marshall, Mich."; *Sewage and Industrial Wastes*, November.

Treating Radio-Active Wastes

The author describes the most recent treatment results at the Atomic Energy Commission's Los Alamos laboratory. Research has been directed chiefly to removal of plutonium from laboratory and laundry wastes. Plutonium is adsorbed to almost any material or surface with which it comes in contact. Of several adsorptive agents tried, activated carbon gave the best results, 500 ppm removing 99% of the activity from spiked tap waters. Activated sludge treatment seemed to be impracticable and chemical precipitation was adopted, using prolonged periods of flocculation and sedimentation, followed by slow filtration. As the water enters the plant, lime (later changed to caustic soda) is mixed in a flash mixer. It is then flocculated for 60 min. and settled and the effluent again flocculated and settled, and passed through sand filters. The sludge is drawn to a holding tank where it is allowed to concentrate and is further dewatered on a vacuum filter. The sludge cake is collected in drums and buried. (Plutonium 239 has a half life of 24,000 yr.) This treatment lowers the counts per minute per liter from an average of 2,000 to 20 or 30. Treatment of laundry wastes by trickling filter was tried; it seemed to be necessary to oxidize practically 100% of the BOD and remove most of the suspended solids to obtain desirable results, but this was effected by use of a two-stage filter.

John F. Newell and C. W. Christenson—"What Treatment for Radioactive Wastes?"; *Engineering News-Record*, Nov. 8.

Pumping Sewage Without a Wet Well

The South Bay Cities Sanitation District found it necessary to place a sewage pumping plant directly on the beach adjacent to a most desirable residential and recreational area; therefore the plant should be inconspicuous and as free as possible from odor. To effect the first, the plant was placed under the concrete walk of the promenade along the sea shore. Believing that the conventional sewage pumping plant wet well is the primary source of odors, it was decided to build a plant without a wet well. It was undesirable to use the 30-in. sewer as a wet well, because this might cause deposits in it. The problem was solved satisfactorily by use of three identical pumps rated at 1700 gpm to which the sewage is led directly.

The pumps were set to match the flow in the sewer as closely as possible and insure a minimum velocity of 2 fps in the incoming sewer. The speed settings for each pump are on 9 equal increments between 400 gpm and 1650 gpm. The speed setting of the pumps is controlled with a floatless system which uses induction relays whose secondary circuits are short circuited by conduction between electrodes immersed in the stilling well connected to the sewer. A blower in the structure withdraws the air and discharges it into the incoming trunksewer, providing oxidation of dissolved sulfides and keeping the plant dry and completely odor free.

Norman W. Anderson and Samuel R. Sanders—"Controlled Pumping of Sewage Without a Wet Well;" *Wastes Engineering*, November.

Higher Loadings On Trickling Filters

Research at the Texas Engineering Experiment Station at A & M College indicates that designers can safely increase loadings on standard rate trickling filters and get equally good effluents. Filters receiving 650 lb. of BOD per acre-foot per day produced effluent of quality similar to those receiving 450 lb. Loads up to 1,000 lb. may be handled with moderate additional dilution in the receiving stream. There was no detectable effect of changes of atmospheric temperature within the range of 37° and 96°. Decrease in efficiency occurs with loadings above 1,000 lb. The average nitrate formation decreases at an accelerated rate beyond loadings of 1,000 lb. and is practically negligible at 1,500 lb. Increased velocity through the filters causes additional sloughing of solids and tends to decrease efficiency of solids removal.

Louis J. Horn—"The Filters Can Be Smaller;" *American City*, November.

Cost of Sludge Disposal

Comparison has been made by John F. Laboon of the relative costs of disposal of sludge by five different methods—A, digestion and open bed drying; B, concentration and incineration of raw sludge; C, concentration, digestion and open bed drying; D, digestion, filtration and incineration; E, filtration and incineration. Annual costs per dry ton for plants of different capacities he gives as follows: 1 mgd plant: A, $27.50; B, $26.30; C, $36.30. 2 mgd: A, $20.50; B, $17.50; C, $23.20. 10 mgd: A, $17.70; B, $14.00; C, $17.10. 40 mgd: B, $9.40; D, $14.70; E, $12.00. 150 mgd: B, $8.65; D, $12.80; E, $10.80.

"Costs Favor Sludge Concentration for Pittsburgh;" *Engineering News-Record*, Nov. 15.

Pollution Abatement At the Source

In 1948 the town of Waynesboro, Va., the three major industries and the State Water Control Bd. joined in cooperative efforts to reduce pollution of the South River. A Du Pont plant was one of the worst offenders and has probably done the best and most effective work in reducing its share of the pollution. The plant BOD has been reduced from 12,000 lb. per day to 3,200 lb. in 1951, chiefly by elimination of waste at the source, through changes in process and in equipment; also by care in operation. "Stream pollution abatement must be the responsibility of the plant operating group. . . . The technical group can lead and point the way, can measure and analyze, but the operating group must do the job of making pollution abatement wholly effective."

Roy McCracken — "Pollution Abatement Program at Du Pont's Waynesboro Plant;" *Water & Sewage Works*, November.

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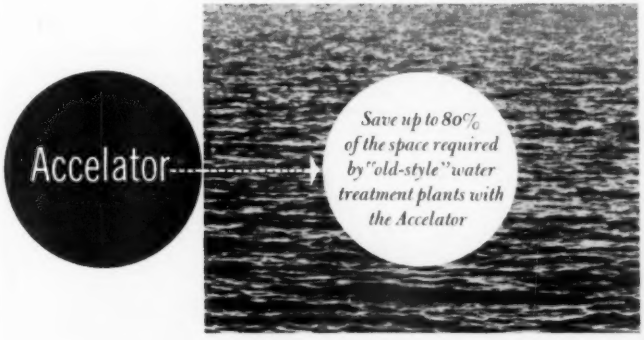

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Income from Parking Meters

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Side Slopes of Cuts in West Virginia

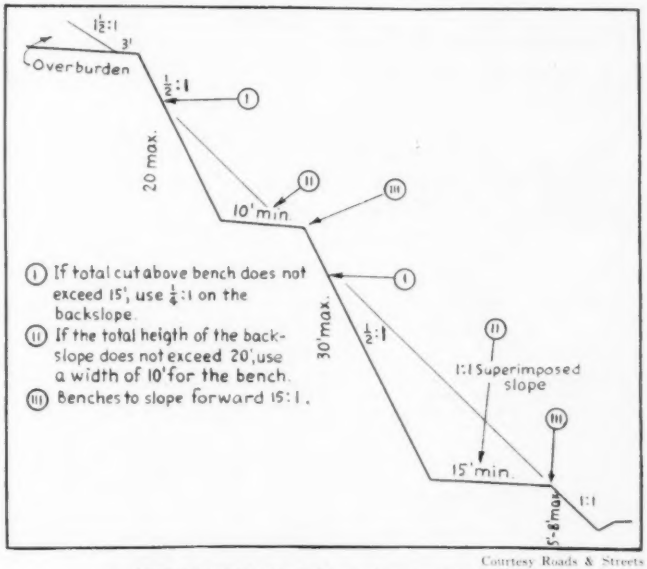
Reconstruction on a new location of a large part of a 5-mile section of U. S. 21 in West Virginia necessitated cuts up to 90 ft. deep and 80-ft. fills. Most of the cutting is in rock, partly shale soft enough to be handled as soil, and some sandstones and hard shales requiring blasting. The road is graded 54 ft. wide, has 5% maximum grades and easy curves. Experience had shown that 1½:1 slopes in cuts in these rocks weathered badly and rock slides onto the roadway were numerous. To prevent this, the State has adopted a standard design which follows generally a 1½:1 slope; but benches are cut into this which serve to catch the weathered material and produce an insulator to the unweathered material. It has become obvious that to continually remove the debris from benches means to continually expose new material to be weathered and subsequently removed. Somewhat different standards are used in sandstone and limestone excavations. But some type of bench is recommended in all cases where the rock is subject to rapid weathering or exfoliation. The slope above the benches can be made steeper than would be desirable without benches and the quantity of excavation is not materially affected. Some weathering of shale rock faces takes place regardless of the steepness of the slope.

R. F. Baker—"Design and Construction of a Relocation for Heavy Traffic;" *Roads and Streets*, November.

Methods for Designing Pavement Thickness

No completely logical method has been evolved for designing pavements for roads and airfields, but numerous and diverse methods, some empirical and others theoretical, are in use by highway authorities. The principal methods now being used have been critically reviewed and assessed by the British Dept. of Scientific and Industrial Research. Their report was summed up by the statement that, of the more than thirty design methods in use, many have little in common either in the assumptions they make or in the results they produce. However, it is possible to classify all design methods roughly into four groups: two for wholly empirical methods, one for semi-empirical, and one for wholly theoretical methods. At present the most reliable methods are (a) The California bearing ratio method for flexible pavements. (b) The shear strength method for pavements on clay subgrades—probably less reliable than the CBR but using a simpler test. (c) Teller and Sutherland's modifications to Westergaard's analysis for calculating the stresses in concrete pavements due to traffic loads, and Thomlinson's theory for calculating the stresses due to temperature changes.

"Pavement Design for Roads and Airfields;" *PUBLIC WORKS*, November.



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Raising a Road 34 Feet

A section of U. S. 69 about 15 miles long in Oklahoma will be covered in places by the water impounded by Fort Gibson dam and this road is being raised above water level, in one place 34 ft. This section includes several culverts and bridges 200 to 300 ft. long. About 7 miles of old concrete slabs had to be broken up and removed. The breaking was done by use of a steel skull-cracker and crawler crane. Where the concrete was reinforced, welders cut the steel. The embankment requires about 1,000,000 cu. yd. of dirt from borrow. Two 3-span bridges

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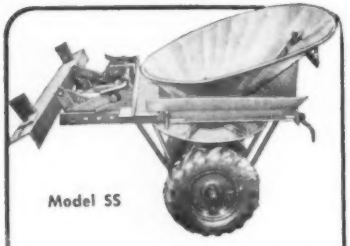

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and one 4-span are being built. The concrete for these abutments and the culverts was one of the first project items to be done. About 14,000 cu. yd. of fill per day is being placed and compacted to 95% density by sheepsfoot rollers.

"Road Grade Raised Above Water Level;" *Contractors and Engineers Monthly*, November.

Prestressed Concrete Pavements

The Cement and Concrete Ass'n. of England have been studying test sections of prestressed concrete roads, trying out different methods. One stretch 190 ft. long and 6 in. thick, had two cables 10 in. apart laid along each side of the pavement. At one end the cables were anchored by fanning out the 12 wires comprising each cable for a length of 6 ft. (They found that these should have been hooked at the ends). At the other end each cable was anchored by male and female cones, driven together while the cable was under the desired tension of 70 tons per sq. in., which tension should elongate the cable 12¼ in. and give the concrete a compressive stress of 245 lb. per sq. in. However, only about half the estimated extension of cable was obtained, due to friction between cable and concrete, although each cable had been wrapped in two layers of waterproof paper. In a second test slab 110 ft. long and a third 130 ft. long, the cables were enclosed in thin steel sheaths, but when tensioned, stretched only about two thirds the estimated amount. The cables were uncovered at several points and the steel sheaths found to have been crushed by the compacting of the concrete. Further studies are to be made into the possibilities of a different type of cable and method of placing it in the concrete to minimize the friction.

W. P. Andrews—"Prestressed Concrete Pavements;" *Roads and Road Construction*, October.

Snow Handling In Pennsylvania

Pennsylvania Dept. of Highways finds a major part of the operations of the maintenance forces is to keep 41,000 miles of State highways open for motorists at all times. Last winter the northwestern counties averaged 171 in. of snow and plows worked 83 days, and snow removal and cindering cost $9,245,600. 4,416 units of department-owned equipment were used, and 2,763 plow-equipped trucks were leased. For several years a radio-telephone system has been used in the principal snow counties, and it has been extended to cover the entire state. A frequency modulated network is used, with a central station on top of a mountain north of Harrisburg and each of 66 counties has a fixed station. Each of 11 engineering districts contains a combination transmitter and receiver in the official automobiles of the district engineer, his maintenance engineer and the district mechanic. At Central Headquarters the automobiles of the assistant chief maintenance engineer and an assistant are radio equipped. By a system of relays it is possible to transmit and receive messages from the most remote parts of the state. Thus all snow and cindering forces have a means of virtually instantaneous communication, to call on neighboring counties or the central headquarters for help. As a drift preventive, 14,725,450 ft. of snow fence was erected by mid-November; and 25 miles of evergreens have been planted experimentally.

N. A. Staples, Chf. Maint. Engr. —"Pennsylvania Set With 7200-Unit Winter Fleet;" *Roads and Streets*, November.

Controlling Erosion Of Road Ditches

Several state and county officials, replying to a questionnaire, told their practices and experiences in controlling erosion in roadside ditches. Most of them considered sodding the best method where the grade is not too steep. In Texas the limit for sodding is set at a grade and design that limits the flow to 8 fps in clay or clay loams and 4 fps in sandy soils, where turf-forming grasses are grown; if bunch-type grasses are used, the limiting velocities are ½ of these. A Michigan engineer recommends a ditch with a round, wide bottom sodded with 3 in. local field sod. In Indiana sodding is generally, but not always, confined to 3% grades. In Mississippi sprigging sod is used on slopes up to 3°; solid sod, closely-laid in broad, flat ditches for 3° to 6°. For steeper slopes, check dams, concrete or cobble paving or, in Mississippi, storm sewers are used. Most users of check dams do not like them but know of nothing better. However, Colorado finds them "very successful." They are made of piles of stone or broken concrete, or concrete poured in place; or creosoted wood; or metal; generally about a foot high and so spaced as to reduce the

grade between two successive checks to one which will not cause erosion. In Kansas, "the spacing of checks, in feet, is 100 times the height of each check, divided by the difference between the percent of grade and the percent at which washing is expected to stop," which varies with the type of soil. Indiana finds a brush check dam more satisfactory than masonry or metal, as well as cheaper. Mississippi has used storm sewers with great success on long, steep grades, with drop inlets, backed up by a check of some kind and surrounded by solid sod. This is especially successful in areas of sandy soil and heavy rains.

"Erosion Control in Road Ditches;" *Better Roads*, November.

Selecting Trucks and Graders

The 1½-ton dump-truck is that most commonly preferred for routine maintenance. If to be used for snow removal or off-the-road operation, a reserve of power is desirable and the frame construction should be heavy and rigid. They should have 4 forward speeds. Trucks of more than 3 tons should have 5 forward speeds and vacuum booster or air brakes on all four wheels. All-wheel drive may be desirable for off-the-road or snow removal work. The B.P.R. usually requires, for trucks of more than 15,000 lb. gross vehicle weight, sufficient power to ascend a continuous 3% grade in direct drive at 20 mph. Trucks of more than 5-ton capacity are ordinarily used only for hauling aggregate, snow-plowing, slide removal, and mounting of heavy units such as large distributors and supply tanks, winches, cranes, large blade plows and rotaries for snow removal. Consider the loads that can be imposed on the roads and bridges over which the trucks are to operate.

Most motor graders used in highway maintenance can be classed as light, medium or heavy-duty. Light graders are satisfactory for light blading on gravel roads and for ditch cleaning where the soils are not heavy. For heavy soils and reshaping and bank sloping, medium graders are usually preferable. The heavy-duty grader is preferred when the work includes road-mixing of bituminous materials, grading, shoulder-blading, bank work where soils are heavy or rocky, and snow and ice removal. Light graders should have at least 4 forward speeds; medium and heavy graders 6 forward and 2 reverse; road speed at least 15 mph in high gear. Power-operated controls, length of wheel base, length of blade and adjustability of blade are significant. All-wheel drive may be needed. Tandem drive increases traction. Having both front and rear-wheel steering increases maneuverability.

To decrease idle time, many owners use trucks and motor graders for many purposes. Wheel-type tractors are usually equipped with front, side and rear power take-off. Attachments that can be towed or mounted include mowers, rotary brooms, front-end loaders, bulldozers, snow plows, grader blades and post-hole diggers.

H. A. Radzikowski—"Balancing a Maintenance Fleet;" *Better Roads*, November.

Using Curb And Gutter Machines

Bay City, Mich., has used a curb and gutter machine and finds it very satisfactory. It increased production 15% to 20%; eliminated over-time finishing for concrete poured near closing-time, as little further troweling was needed; concrete can be poured during light rains. It can be used on moderately long curves but

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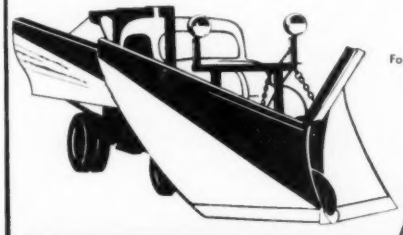

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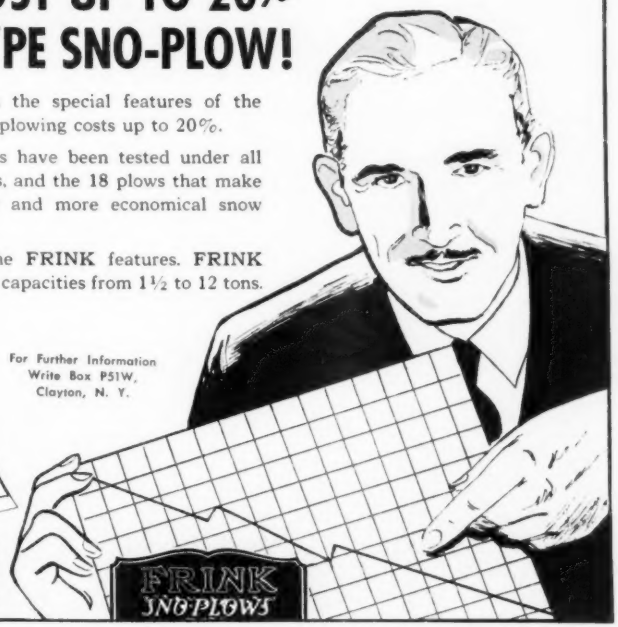

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not on street corners or similar small curves; a small crew follows the machine to construct such short curves and curb around catch basins. For transporting the machine across intersecting streets or from job to job, they use a frame and hoist mounted on a dump truck; while the machine is elevated by this they can easily clean it, which must be done daily. The final finish is greatly improved by placing in the rear hopper concrete with fine aggregate mixed by a small mixer; that for the body of the curb is ready-mix air-entrained concrete.

R. K. McGillivray—"Laying Curbs and Gutters by Machine;" PUBLIC WORKS, December.

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Maintenance: Highways Are Not Good Without It. By *C. F. Woodin*, Sup. H'way Engr. of Maint. Sept.-Oct., Pp. 29-34.

Development of a Test Method (Cement Alkali-Aggregate Reaction) and Its Practical Consequences. By *W. L. Haskell*, Assoc. Materials & Research Engr. Sept.-Oct., Pp. 39-41.

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How to Choose the Proper Size Excavator. By *E. O. Martinson*, V. P. Koehring Co. November, Pp. 75, 76, 78-80.

Bucket, Dipper Sizes and Hourly Capacity. By *E. O. Martinson*, V. P. Koehring Co. December, Pp. 67-68, 70.

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Turnpike Hottest Job in Jersey. By *Michael A. Sprouck*, Assoc. Editor. November, Pp. 20-25.

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Traffic Trends on Rural Roads in 1950. By *Thomas B. Dimmick*, Head, Current Data Analysis Unit, B.P.R. December, Pp. 225-235.

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A Method of Constructing Dummy Joints Using Preformed Supports. By *J. A. Loe, O. D. Loe* and *B. A. Broad*. October, Pp. 285-288.

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Design and Construction on a Relocation for Heavy Traffic. (On U. S. 21, West Virginia). By *R. F. Baker*, Engr. of Soil Mech. W. Va. November, Pp. 40-46.

Pennsylvania Set with 72100-Unit Winter Fleet. By *N. A. Staples*, Chf. Maint. Engr. November, Pp. 42, 87.

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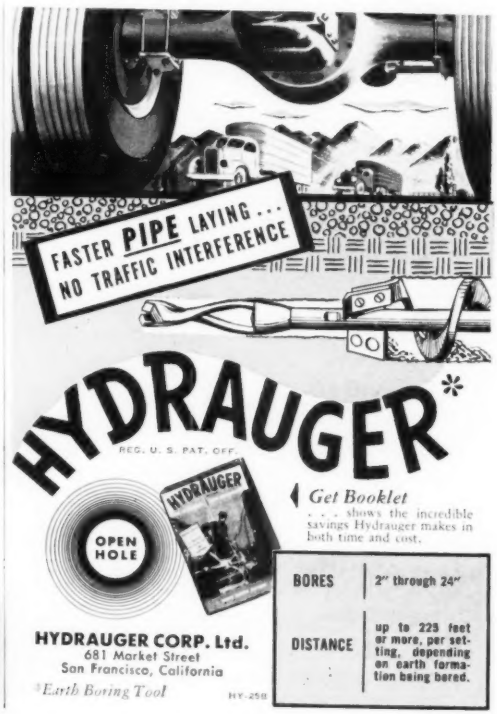

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What Oregon Is Doing to Develop Better Bituminous Roads. By *R. H. Baldock*, State H'way Engr. November, Pp. 64, 66, 67, 68, 74.
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Effect of Frost on Road Bearing Capacity

Tests on the effect of frost on the load-carrying capacity of roads have been conducted by several state highway departments for three or more years, by measuring the capacity at a given spot in the fall, and again at the same spot after the frost has thawed the following spring and summer. The reports on these tests for 1950 by the states of Iowa, Michigan, Minnesota, New York, North Dakota and Ohio are combined in a report of a committee of the Highway Research Board. Summarizing them, the committee says that they all report a loss of strength in the spring by all types of soil. Tests were made by plate-bearing tests and by ring shear, North Dakota cone and the Housel penetrometer. The first seems to be the most reliable and to give the most consistent results, the correlation between these and the instrument tests being inconclusive. All of them, however, show a loss of strength. It seems to be probable that instrument testing, when applied to soils as they are found in the field, may be seriously affected or influenced by some minor special condition encountered in the soil, and is too delicate to be reliable except for fine-grain soils of uniform texture.

The plate-bearing tests appear to indicate that lacustrine soils suffer much greater loss in carrying capacity than do alluvial or outwash. Iowa reported a tendency of emulsion treated base to retain a major portion of its strength through the thawing period, due to the stiffening of the asphalt during cool weather; but with increased temperature following this, and a softening of the asphalt, there was a decided weakening of the base.

Minnesota reported an average loss of 42%—the thickness of the base apparently had no effect, the loss being in the subsoil. The base thickness did, however, improve the bearing capacity at all seasons, but not the difference in capacities. New York found that the load-bearing capacity in the spring averages from 53 to 86% of the fall values for all soil types tested. For lacustrine soils, the spring values are approximately 55% of the fall values. Ohio found a loss of approximately 50% in the subgrade bearing power during the spring thaw period.

The effect of freezing on the bearing power of soils, and of the temperature on frozen sbils, was studied by the University of Minnesota. Their tests indicate that the bearing power of frozen soils varies with their texture; frozen clay showed the least; then came silt loam, sandy loam, and sand, which was the highest. The bearing power of ice is slightly more than of clay. The bearing power of frozen soils increases as the temperature decreases; at 0° F it may be several times that at 30° F. The bearing power increases with the density; also with the moisture content; although when thawed, the bearing value decreases as moisture content increases.

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Fundamentals In Rate Making

A report on fundamentals in rate making and rate structures has been prepared by interprofessional cooperation of lawyers representing the Section of Municipal Law of the American Bar Ass'n and engineers representing the American Society of Civil Engineers in an effort to clarify confused thinking by an agreement by the engineering, financial and legal professions on some basic principles. An outline of the matter contained in the ten chapters of this report is given in this article. In discussing what is a fair rate structure for financing the construction, administration, operation and maintenance of water and sewage works, the report states as a premise "The needed total annual revenue of a water and sewage works shall be contributed by users and non-users (or by users and properties) for whose use, need and benefit the facilities of the works are provided, approximately in proportion to the cost of providing the use and the benefits of the works." Amplifying this, the report says: Each property, occupied or not, receives benefits, either actual or latent, from the existence of water and sewage works in the community. And it is further benefited by the existence of water mains and sewers in the streets adjacent to the property. Each person, whether a user or non-user, is benefited by the existence of water and sewage works in the community, through improved public health, fire protection or drainage, and through civic improvement, industrial property and property development. Each person who is a user is benefited to a greater degree than the non-user. After laying a foundation for the careful drawing of a rate structure, it discusses methods of enforcing payment of the charges. The 126-page report is published by Ohio State University in the State Law Journal.

Wm. F. Tempest—"Rates and Rate Structures for Water and Sewage Works;" *Water & Sewage Works*, November.

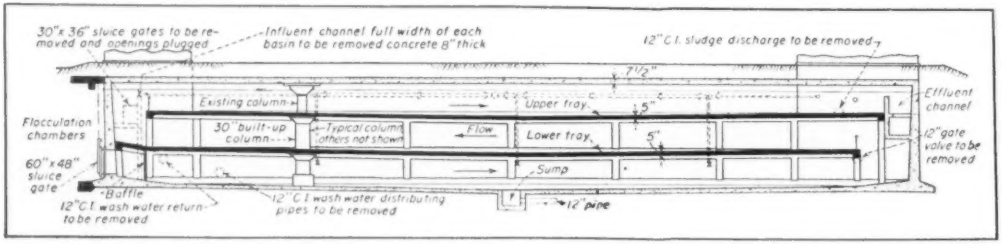
Diatomite Filters For Emergency Use

The author, a research assistant in the Univ. of Illinois, recommends diatomite filters as one of the least expensive and most economical types of portable filtration equipment available, being light, sturdy, relatively cheap to operate, and producing a filter effluent comparable to, or better than, that from rapid sand filters. They are available in sizes ranging from 0.5 sq. ft. to 150 sq. ft. of filter area. The cost of a typical unit sufficient for municipal use varies from about $125 for a 0.5-sq. ft. filter to $2,000 for a 150-sq. ft. filter. The operating cost for a 25 sq. ft. filter under optimum conditions is about $5 per week. Portable diatomite filters may be either truck-mounted or unattached. A truck-mounted unit consists of a filter, a separate slurry feeder, a pump, motor and possibly a precoat tank, all connected up and ready for use. It can be operated more economically than the unattached units, which have no slurry feeder for body coat, which feeder makes possible longer filter runs. But the truck-mounted costs more and the truck itself is tied up with the filter, which may not be used more than once in several years. The portability of the truck-mounted permits its being taken instantly to any emergency point and put into immediate service. Several communities having municipal water supplies and located within a short distance of each other could cooperate in the joint possession of one or more truck-mounted units to be kept in a central location for emergency use by any of them.

Deward M. Martin — "Portable Diatomite Filters for Emergency Use;" *Water & Sewage Works*, November.

Trays Increase Settling Tank Capacity

Cambridge, Mass. water works has for some years had two covered settling tanks about 18 ft. deep which provided a detention period of 94 min. and a mean velocity of flow through them of 1.44 fpm. Efficiency was very low, and in 1930 it had


30"x 36" sluice gates to be removed and openings plugged
Influent channel full width of each basin to be removed concrete 8" thick
12" C.I. sludge discharge to be removed
7½"
Existing column
Upper tray
Effluent channel
Flocculation chambers
30" built-up column
Typical column, others not shown
Flow
Lower tray
5"
12" gate valve to be removed
60"x48" sluice gate
Sump
Baffle
12" C.I. wash water return to be removed
12" C.I. wash water distributing pipes to be removed
12" pipe

Courtesy Engineering News-Record

● ***LONGITUDINAL** section through rebuilt settling basin at Cambridge.*

been proposed to add a basin twice this size. Instead of that, each basin recently has been provided with two shelves, dividing the through-flowing water into three streams, each about 5 ft. deep, and reducing the overflow rate per unit of settling tank floor area to a little over one-third. The flowing through rate in the two lower passes will average 4.1 fpm and over the upper shelf 5.8 fpm. To facilitate sludge removal, each tray drains to openings near its center, and three monitor nozzles are installed at each end of each shelf. Another change is the installation of new flocculator facilities with specially designed stator-plus-rotor mixing devices.

Herman G. Dresser—"Trays Nearly Triple Settling Tank Capacity;" *Engineering News-Record*, Nov. 29.

Removing Radioactive Contaminants

Experiments are being conducted at Oak Ridge National Laboratory on methods of removing radioactive contaminants from water, both in the laboratory and by pilot plants. Among results to date are conclusions that approximately 70% of the radioactive materials contained in the fission products mixture used could be removed by coagulation, sedimentation and filtration; 96-98% of the P^{32} but no measurable removal of I^{131}. Ferric chloride as a coagulant effected slightly greater removals than did alum. The supplemental addition of 4 ppm of activated carbon to the coagulation procedure resulted in the overall removal of approximately 26% of the I^{131}; laboratory tests indicated that copper sulfate or silver nitrate with alum had a similar effect. The use of clay turbidity with alum coagulation increased removals of radioactive materials slightly.

Conrad P. Straub, Roy J. Morton and Oliver R. Placak—"Studies on the Removal of Radioactive Contaminants from Water;" *Journal, American Water Works Ass'n*, October.

Limestone Improves Coagulation

Good coagulation is the secret of good filtration by either sand or diatomaceous filters. Limestone as a coagulant aid has been under investigation for several years. It has been found that limestone pulverized so that more than 90% will pass through a 100-mesh sieve used in connection with alum has a marked steadying influence upon coagulation, in some cases improving results by 50 to 100% in laboratory tests. It improves removal of turbidity and color, accelerates coagulation and precipitation. The most obvious advantages appeared in waters which lacked all of the components supplied by the limestone, such as suspended solids, alkalinity and strong cations. Even when these constituents were present in moderate quantities the limestone appeared to act as a catalyst capable of steadying the performance of suspended solids contact basins as well as intermittent batch treatments. The necessity for flocculation tests and pH determinations is reduced or eliminated.

Charles H. Spaulding, Harry N. Lowe, Jr. and Richard P. Schmitt—"Improved Coagulation by the Use of Pulverized Limestone;" *Journal American Water Works Ass'n*, October.

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American Water Works Ass'n Journal

Mutual Interests of the Water Works and Atomic Energy Industries. By *Arthur E. Gorman*, San. Engr., Atomic Energy Com'n. November Pp., 865-871.

Fluctuations in Water Use and Revenue. Panel discussion. November, Pp. 877-882.

Technical Practices in Cathodic Protection. Bulletin of the Correlating Committee on Cathodic Protection. November, Pp. 883-896.

Water Supply in Finland. By *Amos J. Alter*, Dept. of Health, Juneau, Alaska. November, Pp. 897-903.

Frost Penetration in Montana Soils. By *John W. Hall*, Cons. Engr. November, Pp. 904-908.

Cold Weather Operation of Distribution Systems. By *E. J. Van Deusen*, Supt. of Water, Malone, N. Y. November, Pp. 909-910.

Relation of Frost Penetration to Underground Water Lines. By *James Petrica*, Cons. Engr. November, Pp. 911-916.

Utility Acquisition of Customer-Owned Meters. By *Eric F. Johnson*, Asst. Sec. A.W.W.A. November, Pp. 917-921.

Studies on Chlorine Demand Constants. By *Douglas Feben* and *Michael J. Taras*, Dept. of Water Supply, Detroit, Mich. November, Pp. 922-932.

Rain Increase Projects in Relation to Water Resources. By *Irving P. Krick*, Water Resources Development Corp. November, Pp. 933-936.

Relationship of Water and Sewage Works Financing. By *John W. Cunningham*, Cons. Engr. November, Pp. 937-940.

Disposal of Wastes from Water Purification and Softening Plants. Committee Report. November, Pp. 941-942.

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300-Foot Pipe Is Lowered by Bolts to River Bed. (Across Charles River, Boston). By *James M. Connolly*, Assoc. Editor. December, Pp. 46-48.

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Trays Nearly Triple Settling Tank Capacity (Cambridge, Mass. W. W.) By Herman G. Dresser, Cons. Engr. Nov. 29, Pp. 32-34, 37.

U. S. Public Health Service Research Grants Available for Work in Sanitary Engineering. (Including water, waste disposal and rodent control.) By *Irving Gerring*, U.S.P.H.S. Dec. 6, Pp. 41-42.

Public Works

New Water Works Facilities for Winston-Salem. By *Francis S. Friel*, Cons. Engr. December, Pp. 45-46, 90.

Expanding Cincinnati's Water System. December, Pp. 52-53.

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L'Etablissement Filtrant et Elevatoire de Saint-Maur (Seine). By *M. Spacher*. November, Pp. 21-24.

Le Melangeur Thermostatique. Une solution au problemie de melange des eaux. By *Mr. Ledoux* and *Van Immerseel*. November, Pp. 25-28.

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Fluoride Feeding. By *L. E. Harper*, Pres. Omega Machine Co. November, Pp. 466-474.

Free Chlorine, Monochloramine and Dechloramine in Water. By *D. B. Williams*, Brantford, Ont., Water Works. November, Pp. 475-477.

Determination of Toxic Materials in Water Supplies. By *C. E. Ruckhoft, W. A. Moore* and *F. M. Middleton*, U.S.P.H.S. November, Pp. 482-483.

Toxicology as Applied to Public Water Supplies. By *C. W. Muehlberger*, State Dept. of Health, Mich. November, Pp. 483-484.

Portable Diatomite Filters for Emergency Use. By *Deward M. Martin*, Research Asst. Univ. of Illinois. November, Pp. 485-487.

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Water Supply Development at Brisbane, Australia. By *H. Bowden Fletcher*. November, Pp. 1052-1053, 1091.

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Concord, N. C. Water Works Yesterday and Today. By *Morris Tarlton*, Plant Chemist. November, Pp. 1055-1056.

Old Steel Pipe Cement Coated and Used for Submerged Line. By *Nico J. P. Verbruggen*, Engr. Mun. W. W., Amsterdam, Holland. November, Pp. 1057, 1082.

Shiraz, Iran, Has Country's First Modern Water Plant. By *Charles R. Stempf*, Worthington Pump & Mach. Corp. November, Pp. 1063-1064, 1097.

Diatomite Type Filters Studied by Tests at Los Angeles, Calif. November, Pp. 1065, 1098.

Location of Big Leak in Main Found Only by Careful Research. By *Neal Knight*, Rader Eng. Co., November, Pp. 1069, 1092.

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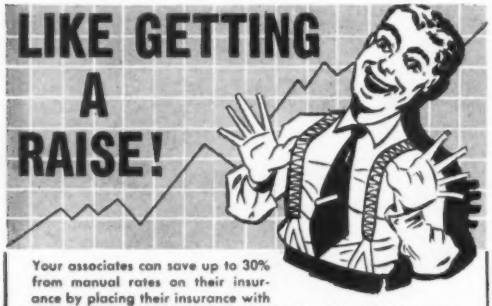
Curb Design to Increase Road Safety

In Roads and Road Construction [1951, 29 (341)], 143-6, is an article by R. C. Humbert, which is summarized in Road Abstracts. Several proprietary types of faceted curb unit are described and illustrated; recesses may be painted to convey information or warnings, or to increase reflecting power. The units are designed to deflect vehicles away from the curb and to give rise to sound or mechanical vibration when touched by a moving wheel. It is claimed that the elements are non-skid, self-cleaning, easily precast, and readily installed and removed.



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Dehumidification for Pipe Galleries of Filter Plants

This article describes the installation at Chicago's South District Filter Plant. It is a condensation of an article by F. G. Gordon, Assistant City Engineer, in "Pure Water", the monthly publication of that plant.

DEHUMIDIFICATION equipment was installed at the Chicago South District Filtration Plant to provide dry filter pipe galleries and thus check corrosion of pipe and equipment, reduce equipment failures, cut maintenance and improve working conditions. So far as is known, it is the first installation for this purpose in the United States. Its use in the filter galleries was preceded by a pilot installation in the west pump room which was placed in operation in 1948. (This was described in the April, 1949 issue of Public Works.) The results obtained with this initial equipment were so satisfactory that plans and specifications for the larger units were prepared and a contract awarded for their construction.

The problem is one of removing moisture from the air in sufficient volume to prevent its condensation on cool surfaces such as concrete walls, pipes, valves, controllers and other equipment. This may be accomplished either by (1) lowering the temperature of the air or (2) by the use of sorbents.

In the first method the air is either passed over cooling coils or cooled with an air washer to a temperature where the dew-point is low enough to prevent condensation on cold surfaces. In the second method, the air is brought in contact with sorbents (substances) which have the property of extracting and holding water vapor. Substances used for this purpose have a capacity for moisture which is large compared to their volume and weight. The terminology employed is of interest. If the substance does not change physically or chemically during the process it is known as air "adsorbent". Examples of adsorbents are activated alumina, silica gel and activated bauxities. If the substance changes either physically, chemically, or both during the process it is known as an "absorbent". Calcium chloride is a solid absorbent, while liquid absorbents include solutions of lithium chloride, calcium chloride, lithium bromide and the cythlene glycols.

The second method employing lithium chloride is the one used at the South District Filtration Plant. The Kathene liquid used (lithium chloride) is non-explosive and non-inflammable. The equipment consists of a dehydrating unit through which air is passed with provision outside the unit for distribution of the dry air throughout the area served.

The dry air is discharged down one gallery, crosses to and back through the adjacent parallel one and to the dehydrating unit. The operating cycle consists of passing the air to be dehumidified through a spray of the solution. The solution is pumped continuously from the sump, a part of the discharge going to the regenerator for the removal of excess moisture. As the spray picks up moisture from the air, the liquid level in the sump rises and at a predetermined point operates the float switch, thus starting the regenerator fan and opening up the steam valve to the regenerator.

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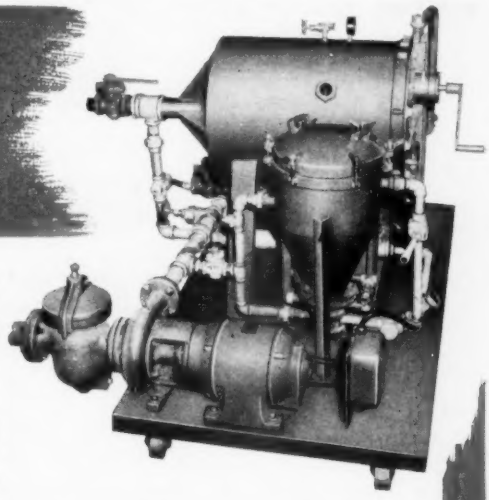

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With the heating of the solution, it gives up moisture which is removed by the waste air fan. When, as a result of this removal of moisture, the level of the solution in the sump has dropped to the correct elevation, the float switch cuts off the steam supply to the regenerator. The exhaust fan continues to run, however, until the waste air temperature is lowered. It is then stopped by the thermostat. The operation just described is the regenerating cycle.

The units are self contained and require only occasional inspection. They are opened up and cleaned annually to guard against possible breakdown and to renew some of the Kathene solution, but otherwise require very little maintenance. The savings in the cost of maintenance of instruments and filter equipment in the parts of the plant where the dehumidifying equipment is in operation, particularly in eliminating most of the severe corrosion conditions, should more than pay for the cost of the dehumidifying equipment in a few years.

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Sanitary Landfill in the Cold North

A REPORT on the experimental sanitary landfill at Mandan, N. D., was made about a year ago. Donald M. Keagy, Sanitary Engineer of the North Dakota Dept. of Health, reports in the N. D. W. S. W. Bulletin, on his observations on this project since then.

Top elevation of the cover material for each cell was determined four times: initially, at the time the cell was completed, in January, 1950, May, 1950, and June, 1951. These elevations indicate that nearly all of the settlement takes place in the first six months. However, there are various factors which may influence this initial settlement.

The procedures used by the operator of the tractor in compacting and covering the refuse and the amount of earth buried with it apparently have more bearing on the percentage of settlement than any other factor. Weather conditions are important. An operator probably will not compact the refuse and cover materials as thoroughly at 20 degrees below zero as he will at 60 degrees above zero. An enclosed, heated cab for the operator during the winter months would materially reduce the effect of this factor.

The type of refuse accepted at the site for burial is another factor. The sanitary landfill which is constructed of everything and anything will probably show a different per cent of settlement, other conditions being constant, than that shown by the fill which consists only of separated household garbage. For varying reasons, a project may exclude trees, brush, broken street pavement, street sweepings, tires, wire, liquids such as waste oil, etc., or any combination of these. The separation and baling of cardboard at the landfill site for resale is also being practiced.

A factor which is very apparent at Mandan is the winter cold with its accompanying snow and ice. Frozen garbage cannot be compacted as well as unfrozen garbage. Snow and ice which will invariably be incorporated in a fill in winter will leave voids when it melts in the spring. In May of this year at Mandan, one could look at the surface of the covered cells and easily point out the area filled during the winter months. Settlement, or caving-in, to the extent of 1 or 2 feet, was observed at the location of these cells which were initially 6 to 8

feet deep. The cells constructed during the warmer months, however, showed almost no apparent settling.

Operational routine at the site as regards the routing of the vehicles and the tractor during the day will greatly affect the percentage of settlement. It seems advisable to route the vehicles over the completed cells as much as is practical and feasible for further compaction. The track-type tractor appears to be best for this work.

The depth of the refuse in the cell and the number of cells constructed on top of one another is another factor. At Mandan, the original depth of the cells was approximately 12 feet in cells 1 through 5. The depth in cells 6 and 7 varied from 14 feet to 7 feet. Also these latter two cells were used for winter operations during the months of coldest weather and heaviest snowfall. It is felt that these latter cold weather factors influenced the greater amount of settlement at these stations more than did the depth of the refuse.

• • •

Sludge is Big Business in New York

The new 260-ft. diesel powered "Owls Head" was launched on Oct. 29 at Camden, N. J. This new vessel is the fourth of a fleet for transporting sludge from New York City's sewage treatment plant to an ocean dumping point some 12 miles out at sea. It will carry 68,500 cubic feet of sludge at a time. It cost $1,158,800.

• • •

Curing a Green Water Supply

Many complaints were registered with the town authorities of Chesapeake City, Md., during the year 1950, concerning the green color of the water drawn from some of the taps on the distribution system. It was found that iron bacteria present in the calcite filter and zeolite softener units at the water treatment plant and in the distribution system caused the dispersion of finely divided particles of iron hydrate thereby causing the green color. These iron bacteria thrive on the energy released by the oxidation of the iron. It was found that the organisms can be destroyed by chlorination of the raw water. However, as raw water chlorination would impose an extremely heavy load on the calcite and zeolite filters, it was determined that the best remedy would be to provide additional treatment of the water consisting of aeration, to remove the carbon dioxide and partially oxidize the iron; and coagulation with lime, followed by sedimentation and filtration through the existing filter units or through sand filters which would replace the existing calcite and zeolite filters. This problem was discussed with the town council and as a result a consulting engineer has been employed to prepare plans, specifications and cost estimates for the work. No material progress had been made toward the solution of the problem at the end of the year but it is expected that steps will be taken during 1951.—From the Annual Report of the Bureau of Sanitary Engineering of the Maryland State Dept. of Health, George L. Hall, Chief Engineer.

• • •

High-Rate Filtration at Chicago

Wide publicity and considerable discussion has been given to the adoption of high-rate filtration in Chicago's water purification plant. Speaking as of October, 1951, City Engineer, W. W. DeBerard said that 8 filters at the South District Filtra-

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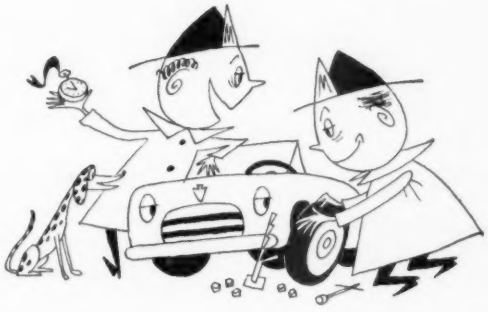

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tion Plant are being operated at rates up to 5 gal. per sq. ft. per minute. This is made possible by the use of coarse sand and of acid-treated sodium silicate to prevent the coagulum from passing through it during cold weather. This has proved so satisfactory that plans for the proposed Central District plant provide for utilizing high rate filtration by making conduits, controllers and pipe lines of sizes adequate for the purpose. The area of the filter beds, however, will be based on the conventional 2 gal. per sq. ft. rate and the additional capacity available will be a factor of safety against contingencies such as unusual demands, unanticipated major repairs, and delays in providing future filter construction where such is needed. This additional capacity can be obtained in this manner at a much lower first cost than by the construction of a new plant.

• • •

Storm Drain Research

Studies, initiated three years ago by the Bureau of Sanitary Engrg., Maryland State Dept. of Health, to obtain and coordinate basic data for use in the design of storm drains, were continued during the year at The Johns Hopkins University through the financial assistance of Baltimore City, Baltimore County and the State Roads Commission. A more effective type of storm water inlet than the conventional type has been developed which will remove storm water from the streets more rapidly. Typical inlets of the new pattern are in use for observation at several locations and in due time calibrations on a practical scale will be available to support the laboratory findings.

During the year gaging stations to determine the depth of flow in storm drains were installed in four existing drains along with automatic rainfall gaging stations nearby in order to coordinate the quantity of runoff in the drains with the rate of rainfall on the surface. Installations are being made at five other locations and as a result accurate records should be available soon from nine separate and distinct drainage areas. Studies are under way to develop an economical but accurate velocity meter for installation in storm drains to record electrically the velocities at various depths of flow. With data available from the rain gages, depths of water and the velocity meters, much that has not been known heretofore

about storm drainage will become available. Assumptions used in the past which, to a large extent, have been based on the judgement of the designing engineer, will no longer be necessary.

• • •

Sand Washing at Slow Sand Filters

The former method of washing the sand for the slow sand filters used by the Hartford Water Bureau has been discontinued. Formerly a Bayard washing machine was used. In the new process, a tractor drawn harrow is dragged over the surface of the sand which has been flooded to a depth of about 9 ins. The filter sump well discharge outlets are kept open, causing a steady flow of water toward the sump. As the harrow is dragged over the sand, dirt in the top sand layers is freed, is caught by the moving stream of water, and carried away. When the water depth on the filter sand drops to about 3 ins., operations are suspended until the depth is brought back to 9 ins. The 14 filters were harrowed a total of 76 times and four of the filters were resanded during the year. Average rate of filtration was 4.34 mgad, with maximum rates running as high as 6.9 mgad.

• • •

Sanitary Landfill in Maryland

Baltimore City continued to dispose of mixed refuse at the sanitary landfill located in Herring Run Park. A total of 194,888 tons was placed in the landfill during 1950, consisting of garbage, rubbish, ashes and street dirt. Mixed refuse comprised 80.4 percent of the total, 1.4 percent was market refuse, 12.6 percent ashes, and 5.6 percent street dirt. All material was collected by the city. The cost of disposing of the material in the landfill for 1950 was $0.53 per ton.

Westminster continued to dispose of refuse on a municipal dump. Particular care is taken to prevent the dump from becoming a nuisance. Continuous programs of insect and rodent control are practised and the refuse is covered regularly.

A program of establishing refuse dumps, at strategic points, has been instituted in Harford County. The purpose of the program is to provide refuse disposal points for persons living in the rural areas who do not have the services of organized refuse collection and disposal facilities. It is hoped, with the provision of such dumps, that indiscriminate disposal

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of refuse along the highways will cease. The county highway department provides equipment periodically to cover the material placed in these dumps and they are policed regularly. As the program is extended better operation and care will become possible.—Annual Report of the Bureau of Sanitary Engineering, George L. Hall, Chief Engineer.

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Industry and City Cooperate

(*Continued from page 47*)

of 790 pounds of BOD per acre foot per day. This loading was planned intentionally to give a well nitrified effluent. Through the use of two-stage filtration, a saving of approximately 50% in filter volume is effected over a design based on a single stage filter with a loading of 400 pounds per acre foot per day. The surface loading of the first filter will be 6.65 million gallons per acre per day and the loading of the secondary will be 3.3 million gallons per acre per day. The BOD of the final effluent is expected to be less than 40 parts per million. The two filters are each 60 feet in diameter and have an average rock depth of 8.5 feet with Dickey filter underdrains. On the basis of 6,000 equivalent design population (based on BOD) the digester capacity is 2.9 cubic feet per equivalent population. The digester will be equipped with an external heat exchanger and will be insulated with asphalt enclosed preformed fiberglass. Four sludge drying beds with concrete driveways provide 6,000 square feet of open sludge drying area. Sludge bed drainage will be returned to the treatment process.

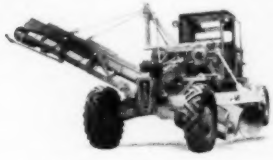
This plant site was a considerable distance from the city. It was decided to drill a well for water supply instead of extending the city water. This has the advantage of not requiring elaborate precautionary measures to protect the city water against backflow from points of use at the plant.

The new plant was designed by Kenneth Larkin and Associates of Kansas City, Missouri. A general contract for construction of the sewage treatment plant was awarded to the Prestressed Concrete Corporation at Kansas City, Missouri for $123,872. The Walters Sand Company at Manhattan, Kansas, was awarded the contract for constructing the outfall sewer for $16,340.

Public Works EQUIPMENT NEWS

Elevating Grader Attachment for Motor Grader

This is the "Elegrader." It is designed for attachment to the Adams 550 and 610 motor graders. It transforms such a grader into a dirt-mover with almost unbelievable capacity. The makers say that on a recent field test this attachment moved 180,000 cubic yards of dirt in 176 hours of operation and that the hourly output at times exceeded 1500 cu. yds. No welding, cutting or major alterations are necessary to mount the Elegrader. Full data from Williams & Reisser Co., Omaha 1, Nebr., or by using the coupon.



Elegrader moves more dirt.

Use coupon on page 17; circle No. 1-1

For Monitoring Area Gamma Radiations

This is a new instrument that detects and records dangerous gamma radiations in an area and sounds an alarm when average tolerance limits are exceeded. Range is from one-half to 5 times tolerance, which is 6.25 mr/hr, with an overall plus or minus of 10%. Uses 60-cycle, 115 volts. Data from General Electric Co., Schenectady 5, N. Y., or use the coupon.

Use coupon on page 17; circle No. 1-2

Extra-Duty Light-Weight Chain Saw

A light-weight—it knocks down into two sections of less than 35 pounds each—two-man chain saw is available for heavy-duty work. Power is from a 2-cylinder Mercury engine, developing 9 hp. The two sections, the power head and the rail assembly can be assembled in 10 seconds, according to the manufacturers. Operating controls are simplified and consist of a switch, throttle control and choke. The throttle can be operated with either hand. Ask for further details on the DA-211 from Henry Disston & Sons, Inc., Philadelphia, Pa., or use the coupon.

Use coupon on page 17; circle No. 1-3

2-section light saw.

Pocket Drafting Machine Has Many Uses

In one instrument, this provides a T-square, straightedge, triangle, protractor, scale and parallel rules. It is small enough to be carried in the pocket, is self-contained, requires no attachments or board clamps, but is a precision instrument. For full information on the "Paraline", write Loomis Industries, Box 442, Berkeley 1, Calif., or use the coupon.

Use coupon on page 17; circle No. 1-4

Three-Point Backfill Tamper for Soil Compaction

The combination of the pounding of the three tamper feet and the vibration imparted to the soil by their de-synchronized action is claimed to give faster tamping, even with higher lifts, and more uniform coverage. A 105-ft. compressor will operate it. Weighs 125 lbs.; feet are 5-inch. Data from Gunderson-Taylor Machinery Co., Denver 4, Colo., or use the coupon.

Use coupon on page 17; circle No. 1-5

Truck-Mounted Loaders for South American Public Works

The three loaders shown in the accompanying photograph were manufactured by the Eagle Crusher Co., Galion, O., for the Minister of Public Works, Montevideo, Uruguay. These are all-purpose loaders and will handle any loose materials, as dirt, gravel or snow, at the rate of 3 to 5 cubic yards a minute. These loaders are of the same type as used by many state highway departments, they are one-man operated and move at normal highway speeds. For data on similar loaders write Eagle or use the coupon.

Use coupon on page 17; circle No. 1-6

Eagle loaders for SA.

Reduces compaction costs

Work Schedules and Costs on Soil Compaction

Detailed information is available for figuring work schedules and costs on soil compaction using the Barco portable rammer for tamping fill or backfill in restricted areas. A high degree of compaction can be obtained on road and street work, trenches, bridges and dams. Write Barco Mfg. Co., Dep't R-77, 1801 Winnemac Ave., Chicago 40, Ill., or use the coupon.

Use coupon on page 101; circle No. 1-7

Dozers and Ditchers for Ford and Ferguson Tractors

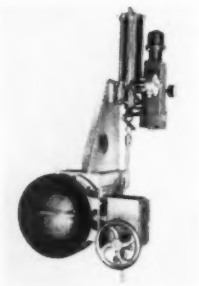
The Shawnee bulldozer blade is 66 ins. wide and 22 ins. high, with hydraulic controls. The Shawnee ditcher has a digging depth of 7 ft., reaches 11 ft. behind the tractor and dumps 75° to either side. Buckets are 10-inch to 20-inch. If you have a Ford or Ferguson tractor, these attachments will help. Shawnee Mfg. Co., 1947 N. Topeka, Topeka, Kans., or use the coupon.

Use coupon on page 17; circle No. 1-8

Small Capacity High Head Submersible Pump

With capacities of 30 to 130 gpm, at heads of 80 to 770 ft., this BJ "Subette" pump is designed for small-capacity, high-head operation from wells 6 ins. in diameter and larger. As a submersible, this pump eliminates alinement and bearing protection problems. Available in four motor sizes. Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles, Calif., or use the coupon.

Use coupon on page 17; circle No. 1-9



Rockwell butterfly valve.

High Pressure Rubber Lined Butterfly Valves

Providing tight shut-off at high pressures, these rubber lined butterfly valves are available in sizes from 4-inch up to 36-inch, or even larger. The rubber lining insures tight closure. Special steels can be provided for corrosive conditions. Automatic operation can be provided. Data from W. S. Rockwell Co., Fairfield, Conn., or use the coupon.

Use coupon on page 17; circle No. 1-10

NEW IMPROVEMENTS
Cable Drum Clutch
Upper Arch Sheave
Automatic Cable Level Wind

OK CHAMPION Power Sewer Cleaner

Twin rigs take debris from sewer to street in one operation.

Mounted on four wheel trucks — safer — eliminates lifting to position over or pull away from manholes — safer tandem towing.

All Controls at Working End — keeps operator out of passing traffic — allows full vision of work.

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Hammond, Indiana

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Address.....

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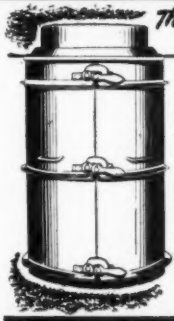


The "Quinn Standard" FOR CONCRETE PIPE

The Quinn Standard is known as the best the world over, wherever concrete pipe is produced and used. Backed by over 35 years' service in the hands of hundreds of Quinn-educated contractors, municipal departments and pipe manufacturers who know from experience that **Quinn pipe forms** and **Quinn mixing formulas** combine to produce the finest concrete pipe at lowest cost.

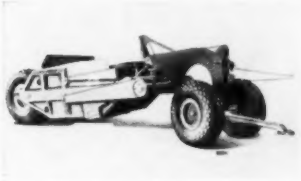
QUINN HEAVY DUTY PIPE FORMS

For making pipe by hand methods by either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and larger—tongue and groove or bell end pipe at lowest cost. **WRITE TODAY.** Complete information, prices, and estimates sent on request. Also manufacturers QUINN CONCRETE PIPE MACHINES.

QUINN WIRE & IRON WORKS 1621 12TH ST. BOONE, IOWA

New Scraper for Greater Earthmoving Production

The new Caterpillar No. 90 scraper has 40% more capacity than previous models. The struck capacity is 21.2 cu. yds., which can be increased to 25.5 cu. yds. by top extensions or sideboards; and heaped capacity is 27 to 31 yds. This unit is designed for use with the D8 tractor. Operation is cable-controlled. When loaded, 60% of the weight is on the rear tires which are 27.00-33. Shipping weight is 35,100 pounds. Additional information from Caterpillar dealers, from Caterpillar Tractor Co., Peoria, Ill., or by using the coupon.



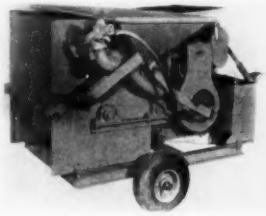
Caterpillar #90 scraper.

Use coupon on page 17; circle No. 1-11

Bituminous Paving or Patching Mixer

Suitable for making hot, heated or cold bituminous mixtures, this portable bituminous mixer of the batch type has a capacity of 3 cubic feet per batch. There are two torch heaters, permitting batches to be raised to 300°F. The unit can be used on practically any combination of aggregates and bitumens. Weight is 1200 pounds and mounting is on 2 rubber-tired wheels. Heated patch material makes a better patch in cold weather. Ask for Bulletin 117-A, K. E. McConnaughey, Lafayette, Ind., or use the coupon.

Use coupon on page 7; circle No. 1-12



Patching mixer

Kelly's Rat Cafeteria for Rodent Control

A new approach to rodent control, this cafeteria, which is available in two sizes, is used with the new rodent-killer, Warfarin or Compound 42. The larger size is used for refuse dumps; the smaller in buildings. Built of steel, it can be locked and wastage is eliminated. Holds up to 6 pounds of bait. Data from Solvit Chemical Co., Inc., Madison, Wisc., or use the coupon.

Use coupon on page 17; circle No. 1-13

Reflectorized Paint for Highway Marking

Applied in the conventional manner, reflectorized paint for highway lines, recently patented, is said to last 3 to 5 times longer and to be three times as bright at night. The tiny glass spheres contained in this paint serve as reflecting lenses and are constantly worn brighter by traffic. More from Minnesota Mining & Mfg. Co., St. Paul 6, Minn., or use the coupon.

Use coupon on page 17; circle No. 1-14

Colaflex Collapsible Air and Gas Diffuser

A new type of equipment is now available for the diffusion, in very fine bubbles, of air or other gases into a liquid. It is adapted to sewage and industrial waste treatment, water conditioning, biological manufacturing processes and absorption. The Colaflex diffuser is a flexible and collapsible unit which maintains practically constant permeability under conditions of use. Several diffuser elements can be

Air and gas diffuser.

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For SAFETY — a WARNING LIGHT, seen from *any* angle nearby or from long distances, the NIGHT WATCH is without equal. Optically correct prisms concentrate the light into a vertical "Pencil Beam" of great intensity. Many exclusive features. Very economical to buy and to operate. Burns 100 hours on a pint of kerosene.

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connected to a common header or duct of any pattern within the tank containing the liquid. The gas or air, under pressure, inflates the element and diffuses through the fabric. Cleaning is readily accomplished by shutting off the air or gas pressure, when the fabric collapses, dislodging the particles that have caused clogging. Bulletin 6530 gives full information. Write Infilco Inc., Tucson, Ariz., or use the coupon.

Use coupon on page 17; circle No. 1-15

Teflon Impellers for Chemical Handling Pumps

The new Eco chemical process pumps have capacities from 1 to 20 gpm and will operate to 40 psi. They have Teflon impellers and stainless steel pump casings and shafts. Du Pont Teflon is chemically and biologically inert, unaffected by acids, solvents or alkalis, and imparts no taste, color or odor. Write Eco Engrg. Co., Newark 1, N. J., or use the coupon.

Use coupon on page 17; circle No. 1-16

High Speed Dual Drum 34E Paver

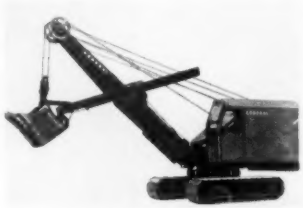
Typical of the speed claimed for this 34E dual drum paver is a boom bucket travel of 256 ft. per minute; the power skip requires 6½ seconds to travel from the ground position to discharge position; transfer from the first to the second mixing compartment requires 6½ seconds, depending somewhat on concrete consistency; discharge into the boom bucket requires 6½ seconds. Boom swing is 171°. Data from Construction Equip. Div., Worthington Pump & Machinery Corp., Dunellen, N. J., or use the coupon.

Speedy dual drum paver

Use coupon on page 17; circle No. 1-17

Shovel-Clamshell-Crane-Dragline-Backhoe-Pile Driver

A new 3/4-yd. excavator and material handler has been added to the General line. It is fully convertible to any of the tools listed in the above head with a minimum of work. Control is manual. Stability is unusually good and lifting capacity high with minimum deadweight. Ground bearing pressures are low. Standard shovel boom length is 18 ft. 8 ins., and crane boom length is 35 ft. Full data from General Excavator Co., Marion, O., or use the coupon.



General excavator.

Use coupon on page 17; circle No. 1-18

PERSONAL NEWS

Promotion of William H. Weir, of the Georgia State Department of Health, to the rank of Colonel in the Army Reserve is announced in Georgia's Health. His contributions, in several difficult assignments, during World War II were outstanding and his promotion is richly deserved.

It is now Hazen and Sawyer, consulting engineers, 110 East 42nd St., New York 17, N. Y. Alfred W. Sawyer, formerly an associate with Malcom Pirnie Engineers, has joined with Richard Hazen to form the new organization.

Harold L. Woodsum, formerly of the Civil Engineering Department, Purdue University, has joined the engineering staff of Soil Testing Service, Chicago, Ill.

ASSOCIATIONS

The 38th Annual Conference on Highway Engineering will be held at the University of Illinois, Urbana, Ill., Feb. 19 to 21. Wm S. Pollard, Jr., Department of Civil Engineering, represents the Highway Conference Committee.

Georgia Tech's second annual quality concrete short course will be held at the college in Atlanta Feb. 4 to 6. Robert E. Stiemke, Director of the School of Civil Engineering is in charge.

The New Jersey Sewage & Industrial Wastes Association will meet at the Traymore Hotel, Atlantic City, N. J., March 12-14.

The American Water Works Association annual convention will be held at the Municipal Auditorium, Kansas City, Mo., May 4 to 9.

The New England Water Works Association convention will be held Sept. 8-10 at Hotel Griswold, Groton, Conn.

The Federation of Sewage & Industrial Wastes Associations annual convention will be held at the Hotel Statler, N. Y., Oct. 6-9.

For Population Loadings from 500 to 5,000,000
Thousands of communities with P. F. T. Floating Cover Digesters enjoy safe carefree operation. P.F.T. Covers provide complete submergence of buoyant sewage solids, more effective and safe collection of sewage sludge gas and more complete digestion. Effective digestion control regardless of what loading or what portion of tank capacity is employed. Consult P. F. T. Engineers for complete data.
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CORRECTION NOTICE

Through an oversight, the advertisement of Ace Pipe Cleaning Contractors, Inc., in the December issue of this publication, carried a wrong telephone number. The Correct telephone number for this company is CHestnut 2891.

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Search *your* plant for this idle metal . . . work with your local scrap dealer to increase supplies of badly-needed iron and steel scrap.

What to look for . . .

obsolete machines, tools and equipment, no-longer-used jigs and fixtures, worn-out or broken chains, wheels, pulleys, gears, pipe, tanks, drums and abandoned metal structures. Non-ferrous is needed, too!

The Southwest Section AWWA, will meet in Tulsa, Okla., Oct. 12-15. The California Section will meet at the Huntingdon Hotel, Pasadena, Calif., Oct. 22-24.

Position Available

The Minnesota Society of Professional Engineers desires applications for the position of Executive Secretary. For fuller information on requirements and duties, write to George O. Pierce, Secretary, 1000 Guardian Bldg., St., Paul 1, Minn. Salary is $4200-$5000.

• • •

Flex-Beams for Temporary Traffic Channelization

J. V. OTTER,
Commissioner of Public Works, Boise, Idaho

ARMCO flex-beams were used for temporary channelization of traffic at several busy intersections. These were utilized as a relatively inexpensive method of determining, under actual conditions, whether the channelization plans prepared by our engineers would perform as expected in segregating and guiding traffic. One such intersection, after about one year of operation, has shown that minor modifications would be useful. It is contemplated that, in the near future, this flex-beam will be replaced with concrete divider strips incorporating such modifications. Certain other intersections may remain indefinitely with flex-beam channel guides.

Special equipment and methods devised by members of our staff include: Special sand traps which were placed temporarily in a number of manholes at Boise Hills Village to determine the source of large quantities of sand which were clogging a main below. This method proved successful permitting localization of the trouble. Also, a device for providing automatic feed of fuel to stationary diesel engines at the sewage plant; a device for odor control at the sludge hopper of the sewage plant; a gas alarm on the Dorr-Varec relief valve at the sewage plant; and scotch-lite on the floating cover of the digester for night observation.

Very efficient operation was obtained with the 27-yd. belly dump Euclid earth-movers used by Morrison-Knudson Co. in their contract with the city for hauling and placing 90,000 cu. yds. of fill for the 16th St. Extension embankment.

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Our staff includes engineers so items requiring some engineering or detailing can be handled.

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One, Allis-Chalmers Type SHH, size 4x3, 450 GPM, 210 foot head with an Allis-Chalmers 40 HP 220 volt motor. All mounted on base. Good.

One, Allis-Chalmers type SH, size 4x4, 500 GPM, 55 foot head, with Allis-Chalmers 10 HP 220/440 volt motor, all mounted on base, used only 172 hours.

Board of Public Utility Commissioners
Sheboygan Falls, Wisconsin

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LASTS
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KONIK metal beats the rigors of a tough culvert life—it resists rust and fights element corrosion. The Continental open hearth steel plus copper, nickel and chromium does it. These sheets are made especially for culvert use because they stand more rough abuse. Continental Steel Corporation, Kokomo, Indiana.

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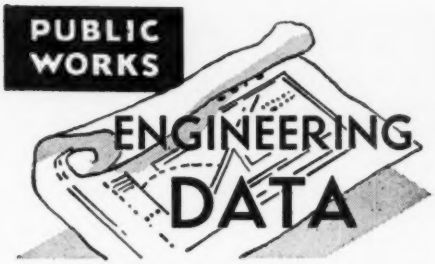

Incinerator Performance in Maryland

The following data concerning the disposal of refuse in the state of Maryland are condensed from items in the annual report for 1950 of the Bureau of Sanitary Engineering of that State.

The Reedbird Avenue incinerator of Baltimore City, which has a rated capacity of 600 tons per day, destroyed 165,760 tons of mixed refuse during 1950. The average daily destruction of refuse was 531 tons, based on a 24-hour day, 6-day week operation. The increase in quantity of material destroyed during 1950 over that handled during 1949 was about 9.0 percent. Average daily destruction for 1950 was 88.8 percent of rated capacity. Total furnace hours for a year was 26,536, with an average of 6.24 tons burned per furnace hour. Smoke density for each month was less than #1 Ringlemann chart. The net operating cost after crediting revenue for sale of salvageable material was $1.74 per ton.

The 60-ton refuse incinerator at Frederick burned 5,538 tons of refuse and 1,783 tons of vacuum-filtered sludge cake, or a total of 7,321 tons of material during the year. Ash production was 501 tons, representing a total reduction in tonnage of material incinerated of approximately 93.2 percent. The increase of material destroyed in 1950 over that during 1949 was 10.1 percent. The total amount of refuse and sludge cake incinerated represents an average daily destruction of 23.5 tons, based on an 8-hour day, 6-day week operation. Total burning time for each furnace was 2,169 hours, or an average of 1.69 tons of material incinerated for each hour of furnace operation. No major repairs were made to the furnaces during the year and no auxiliary fuel was needed. The operating cost of incineration was $1.79 per ton, not including fixed charges.

The two-furnace incinerator at Lyttonsville had its capacity increased on July 1st from 150 tons to 225 by installation of a third furnace. During the year it destroyed 37,566 tons of mixed refuse, or approximately 120.4 tons per day, at a total cost of $2.56 per ton, or $2.06 deducting fixed charges.

The 70-ton incinerator at Bladensburg destroyed a total of 14,547 tons of refuse or approximately 46.6 tons per day. Total cost of operation was $3.57 per ton, or $3.28 per ton not including fixed charges.

Incinerators at Greenbelt and Rising Sun continued to give satisfactory service but no records were kept of the quantities of refuse destroyed, a 125-ton incinerator was completed and placed in operation in December at Salisbury.

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Worth Telling

by Arthur K. Akers

★ **A HAPPY NEW YEAR** to all! And a prosperous one—"after taxes."

★ **TOO BIG** to picture here is INTERNATIONAL HARVESTER'S new motor truck proving ground at Phoenix, Arizona. On it the test fleet rolls 24 hours a day, in temperatures up to 165°.

★ **BYRON A. LAFORGE** has joined CHEMICAL INSECTICIDE CORPORATION, Brooklyn, in technical sales capacity.

Mr. LaForge

Mr. Robertson

★ **HOMER E. ROBERTSON** is the new executive vice president of CAST IRON SOIL PIPE INSTITUTE, Washington, D. C.

★ **CATERPILLAR TRACTOR'S** expansion program includes a new factory in York; Pa.; big additions at Joliet, Ill.; and improvements at Peoria.

★ **THE SANITARY ENGINEERING COMMITTEE** of NATIONAL CLAY PIPE ASSOCIATION stands here. Left

to right: J. J. STEIN, vice president; D. M. STRICKLAND, president; JOHN COOK, secretary-treasurer; MAURICE MASKREY, vice president.

★ **DON McPHERSON** is new district sales manager for HUBER MANUFACTURING COMPANY, Marion, Ohio, in the northeast including all New England, headquartering at Marion.

★ **FAIRBANKS, MORSE & COMPANY** has just awarded contract for a new pump plant in Kansas City. 360,000 square feet of added floor space are involved.

★ **BLAW-KNOX COMPANY,** Pittsburgh, announces election of W. CORDES SNYDER, JR. as president and chief exeeeutive officer of the Blaw-Knox Company, effective November 1. WILLIAM P. WITHEROW, formerly president, will continue as chairman of the board.

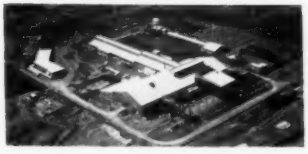
★ **JOHN P. HARRIS** ends a long career with INDUSTRIAL CHEMICAL SALES DIVISION of West Virginia Pulp and Paper Company—and starts another, selling their activated carbons and filtration materials on his own, at 1791 Howard Street, Chicago. JOHN F. ZIESERL succeeds him with Industrial.

★ **A. G. FRERKING** retired January 1 after 44 years with W. S. DICKEY CLAY MANUFACTURING COMPANY in Kansas City, with the comment, "Since DICKEY clay pipe lasts longer than the man who sells it how can I outlive it?"

Mr. Frerking

★ **ALLAN M. HIRSH,** senior founder and former president of Lock Joint Pipe Company, latterly chairman of the board, died Dec. 21. He was graduated from Yale in 1901, and was buried at Warm Springs, Va. We print this with a sense of personal loss.

★ **HERE'S THAT NEW** Decoto, Calif., centrifugal cast iron pipe plant of the UNITED STATES PIPE & FOUNDRY COMPANY. It is U. S.'s fifth plant as they grow with the country.



U. S. Pipe's Decoto plant.

★ **"IT TAKES TWO** to make a marriage—a single girl and her mother," says JACK SERVICE in his SPARLING METROGRAMS. As the father of a daughter, we are in no position to comment.

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Freedom from:

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- ★ Corrosion or deterioration

The water works man who installs Lock Joint Concrete Pressure Pipe will have trouble-free pipe lines. The careful design of Lock Joint Pressure Pipe does not permit blow-out or rupture; its dense concrete walls are immune to tuberculation, corrosion or electrolytic attack; and its useful life has been estimated by competent hydraulic engineers at more than 100 years. Among Lock Joint's strongest supporters are the water works officials who have installed this type of pipe and who point to it as the most economical in their systems.

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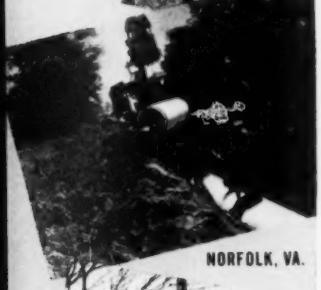
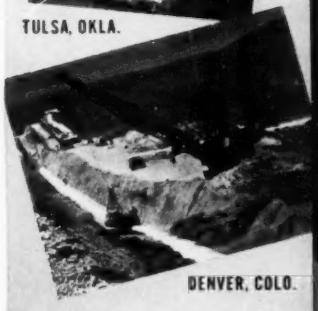


NORFOLK, VA.



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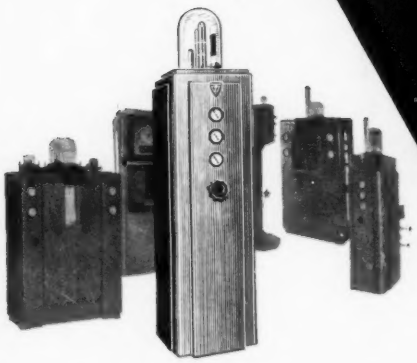

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